VOL. XI, NO. 4. 20TH OCTOBER, 1915.

New Zealand Department of Agriculture,
Industries, and Commerce.

THE

JOURNAL

OF

AGRICULTURE.

Published by direction of
The Hon. W. D. S. MACDONALD,
Minister of Agriculture.

WELLINGTON.
BY AUTHORITY: JOHN MACKAY, GOVERNMENT PRINTER.
—
1915.

The

Journal of Agriculture.

WELLINGTON, NEW ZEALAND.

20TH OCTOBER, 1915.

POTASH IN AGRICULTURE.

B. C. ASTON, F.I.C.

WHAT IS POTASH?

THE word "potash" is somewhat loosely used to denote carbonate of potash (K_2CO_3), the chief form or salt of the metal potassium occurring in wood-ashes. More strictly speaking, "potash" should refer only to the oxide of potassium (K_2O). The word "potash" is derived from the fact that the ashes of plants were boiled down in iron pots in order to separate the carbonate of potash soluble in water from the matter insoluble in water (lime salts, silica, &c.).

Usually only from 5 to 10 per cent. of carbonate of potash is found in wood-ashes, although in young wood and in very dense slow-growing woods more may be found. The amount of ash in wood is very small, ranging from 0·3 to 3 per cent. Until the Stassfurt deposits in Germany were discovered the main supply of

potash was obtained from the very impure source of wood-ashes. On concentrating by evaporation the filtered watery solution of plant-ashes the less soluble constituents crystallize out and are removed by filtration; the clear liquor, on being evaporated to dryness, yields a residue of approximately pure potassium carbonate. It is, of course, not necessary or desirable to proceed in this manner with ashes intended for manurial purposes, for the ashes contain a large quantity (about 50 per cent.) of carbonate (unburnt lime), oxide (burnt or quick lime), and hydrate (slaked lime) of lime in a very fine state, and extremely suitable for top-dressing or for mixing with other fertilizers for drilling in with seed. A small quantity (2 to 10 per cent.) of phosphate of lime, another valuable fertilizer, is also present in plant-ashes. Unless, therefore, it is desired to manufacture pearlash (crude potassium carbonate) for use in the arts, plant-ashes are best disposed of in the untreated state, and may be valued according to their content of potash, phosphoric acid, and lime.

OCCURRENCE OF POTASH IN NATURE.

Although soluble potash compounds are so expensive even in normal times (K_2O is 7s. per unit—$\frac{1}{100}$ ton, or 22·4 lb.—or $3\frac{3}{4}$d. per pound), the insoluble compounds of potassium are most abundant in nature. The percentage of the metal potassium, of which potash is the oxide, has been estimated at 2·45 per cent. of the known solid portion of the earth, and 0·04 per cent. of the ocean where it is in the soluble state. Although so abundant in rocks and in the soils derived from them, potash is so tightly held in the form of silicates that man is unable to economically extract it from the rocks for commercial purposes, but plants easily absorb it from soils. The difficulty of removing potash from soils, and the ease by which soda is removed by rain, may partly explain why the sea contains 1·14 per cent. of sodium but only 0·04 per cent. of potassium, although the proportion of these in the known portion of the solid earth is 2·43 per cent. sodium and 2·45 per cent. potassium. Comparing these figures with that given by Clarke for phosphorus (0·11 per cent.), the wonder grows, although phosphatic fertilizers may be necessary, that potash manures should be used at all. As a matter of fact, the use of potassic fertilizers has undoubtedly been overstimulated by the German Potash Syndicate, and the present is an opportunity for seeing how far agriculture in this country will suffer through the artificial supply being strictly limited. When the war is over, should it be necessary to revert to the use of potash salts in mixed fertilizers, it is hoped that, as mentioned in a previous note in the *Journal*, a supply will be

available from a more popular country. As indicated, the present artificial supplies come from Stassfurt, in Germany, although there are said to be huge deposits in Alsace which are not allowed by the Germans to be worked. More recently deposits have been reported from Spain.

The deposits at Stassfurt are of great extent and several hundred feet thick. It is thought that they are of marine origin, as the order in which the different saline deposits are found accords with what would happen if sea-water from an intermittent supply were slowly evaporated. It may be of interest to note that these salt beds are arranged, beginning at the lowest, somewhat as follows :—

1. Rock salt (sodium chloride or common salt), a bed of immense depth, 2,000 ft. or more in thickness, interspersed with bands of the mineral anhydrite, the composition of which is anhydrous sulphate of lime—that is, practically, gypsum without water of crystallization.

2. Above this is another bed of rock salt, sometimes 200 ft. thick, but in this case it is mixed with bands of magnesium chloride and the mineral polyhalite, which consists of the sulphates of lime, magnesia, and potash, and water of crystallization.

3. On the last bed rests a layer of rock salt, sometimes 100 ft. thick, mixed with strata of the mineral kieserite (sulphate of magnesia, or Epsom salts, with water of crystallization) and other sulphates, about 1 ft. thick.

4. Then comes a reddish layer of rock salt associated with masses of the mineral well known in New Zealand, kainit (sulphates of magnesia and potash with chloride of magnesia and water of crystallization), together with carnallite (chlorides of magnesia and potash with water of crystallization), sylvine (chloride or muriate of potash), and leonite (sulphates of magnesia and potash with water of crystallization).

5. Finally, on the top of all are layers of gypsum (sulphate of lime and water of crystallization), anhydrite, rock salt, clay, shale, 800 ft. of red sandstone, limestone, and lastly the surface soil.

These deposits were originally worked for the sodium chloride which they contained, the potash and magnesium salts being rejected as worthless, so that, although the salt springs of the locality had been known since the thirteenth century, it was not until 1861 that the first works were erected for the extraction of chloride (muriate) of potash.

Potassium salts in considerable quantity are found in certain excretory products of herbivorous animals. These live on the soft growing parts of plants, which are rich in potash (100 lb. of fresh meadow grass contains ½ lb. to 1 lb. of potash). The animal must get rid of the great excess of soluble potash salts which are not

required in building up its tissues, and although potassium is required for every cell-wall and blood-corpuscle, potash is ingested by the animal in much greater quantity than is required. Accordingly the sweat and urine contain large quantities of potash. From the wool of sheep, potash is recovered in the impure wool-grease, "suint," which contains about half its weight of potash salts. For every 100 parts of potash supplied in the food 95 to 97 parts are excreted through the bladder, but for the same amount of magnesia there are only 20 to 30 parts, and of lime 2 to 5 parts, excreted through this channel in herbivoræ. The liquid excretory products of animals must therefore be regarded as fertilizers in which the potash is in a most available form. Farmyard manure contains a comparatively large proportion of potash compared to the other fertilizer ingredients, as one might expect from its origin. Peruvian guano, the recent excreta of sea-birds, is also fairly rich in potash (2 to 4 per cent. K_2O). The phormium-waste from New Zealand flax-mills is another low-grade potash fertilizer, richer than stable manure in potash, and, if burnt, the ash would contain 20 to 30 per cent. of potash. It would, however, be wasteful to burn such a useful organic fertilizer, a far more economical method being to plough it in for such a crop as potatoes, thereby securing the full benefit of the nitrogen and organic matter, which would be lost in burning to an ash.*

Minor supplies of potash have also been obtained from molasses-waste and from sea-weeds. Mention must also be made of the valuable saltpetre earth of Bengal, yielding potassium nitrate, but this is too valuable a salt to be much used in agriculture.

In addition to the above sources of potash there are the insoluble compounds so abundant in nature, such as potash felspar, which contains up to 14 per cent. of potash; potash mica, muscovite, or common mica contains 11·8 per cent. of potash; and several igneous rocks, such as granite and phonolite, contain felspar in varying quantities. In these minerals and rocks the potash is combined with silica in a condition insoluble in water. Various attempts have been made to render the potash of these rocks available for agriculture.†

In America a factory has been started to extract potash from siliceous rocks, and various agricultural chemists have investigated kelp as a source of potash. As yet, however, these attempts have

* For an article on the use of flax-refuse as a manure see this *Journal* for January, 1913.

† My preliminary laboratory experiments have proved that by heating a micaceous soil containing 3·6 per cent. potash with common salt and carbonate of lime, over 80 per cent. of the potash became soluble in water.

not seriously competed with the Stassfurt deposits. The finely ground potash rock has been placed on the market as a potassic fertilizer, but field experiments with it have been invariably disappointing.

FUNCTION OF POTASH IN PLANT-LIFE.

Potassium is one of the elements essential to plant-life, and is especially required for all crops which produce in abundance carbohydrates such as sugars, starches, or cellulose. Instances of these crops are potatoes, sugar-beet, maize, cereals and grasses, fruit-trees, sugar-cane, and mangels. If potash is not present in sufficient quantity, or is in unavailable amount in the soil on which these plants are grown, the appearance of the plant will at once betoken its want. It becomes starved, yellow at the tips of the leaves, and if the plant is analysed it is found deficient in sugar, starch, or cellulose. In the case of cereals the grains are stunted; in the case of root crops the roots are small, and generally potash-starved plants are unhealthy and readily attacked by all sorts of diseases, rusts, and other fungi. Indeed, the healthy tone and resistance to disease conferred on plants by appropriate potash-manuring is one of the most striking of its effects. In New Zealand we have not got to the stage that we manure our flax (phormium) crop, but potash is sure to be a prominent want of this plant which produces cellulose in such quantity, and insoluble sources—ground potash rocks—might be tried with a better chance of success in swamp than on dry-land crops. The clovers and other leguminous plants are also potash-loving crops, and it is supposed that the beneficial effects of basic slag on white clover are in part due to the potash which the lime of the slag liberates from the soil silicates. Plants grown with an unbalanced food ration deficient in potash and phosphates may present a rank fleshy growth more susceptible to the attacks of caterpillars and other animal life than properly manured plants.

POTASH AT A PREMIUM.

Owing to the war the supply of pure potash salts has been largely curtailed, the only sources of supply being in German territory. Supplies can still be obtained under a special British Board of Trade license, through neutral countries such as Holland; but of course, as this would ultimately benefit the enemy, it is obvious that an endeavour should be made to rely on such substitutes for the Stassfurt salts as can be got within this Dominion or the Commonwealth of Australia. There may, of course, arise conditions under which the policy of boycotting the Stassfurt salts might be relaxed if the gain to us by their use is likely to be

hugely disproportionate to the gain of our money to the enemy, and in this case the permission under license through this Department might be availed of.

SUBSTITUTES FOR STASSFURT SALTS IN NEW ZEALAND.

Direct Substitutes.

The problem, therefore, which has to be faced at the present time is how potash may be supplied directly by local substitutes for the German salts, or how it may be supplied indirectly by applying a substance which will liberate potash from the inert soil-silicates at a greater rate than the natural processes going on in the soil accomplish the work, in order that special potash-loving crops may be grown as freely as heretofore. And here I would like to remark that all the potash which is absorbed by the plant is not necessarily fixed there, for it has been demonstrated that every shower of rain removes from the leaves, especially dead leaves, potash compounds, and washes them back into the soil, where they are ready to start on their work again in the plant.

The most natural source of available potash in New Zealand is wood-ashes, which are so abundantly produced when the fallen forest is burnt, and when sawdust, sawmill-refuse, &c., is burnt to an ash. These ashes are often quenched with water to prevent them blowing about. Even then they are valuable as a source of potash, phosphoric acid, and lime, especially the latter. If, however, some means can be adopted of cooling without quenching, and subsequently bagging-up in the dry state, they would be more valuable, through weighing less, in saving labour in handling, in bagging, and in freight. Moreover, none of the extremely soluble potash carbonate is lost, as might be the case in the quenching with water. The accompanying table of analyses will give some idea of the composition of these wood-ashes according to the species of wood burnt.

Apart from the timber-ash there are on every farm accumulations of organic materials, such as hedge-clippings, maize-stalks, straw, fir-needles, dead leaves, bean-stalks, rape-sticks, chaff, hulls and shells of grains, all of which may be ploughed in or burnt and the ashes used. It should be borne in mind that many of these may be ploughed in with a greater advantage in the unburnt state than after reduction to ashes. By burning, any nitrogen is lost completely, but the greatest loss is in organic matter, which is so valuable as a source of humus, and humus is a great factor in decomposing the soil-silicates, and hence in liberating potash and phosphates. The greatest amount of plant-food—potash, phosphoric

acid, and nitrogen—is always in the young growing point of the shrub or tree, and not in the woody portion. Hence hedge-clippings are peculiarly rich, and may be either turned in, when they will soon rot, or burnt to an ash.

To use sea-weed as a source of potash in New Zealand does not seem a very practicable proposition, except on areas near the coast. Large kelp-beds occur in the southern Islands, such as the Auckland, Campbell, and Macquarie Islands, but the stormy seas, distance from market, and absence of means of drying the kelp do not promise an easy conquest for the potash explorer.

Unwashed wool contains $5\frac{1}{2}$ per cent. of potash, which is removed in washing; but most wool is exported in the greasy state, and the potash is lost to this country. The Roubaix district of France in normal times is said to produce £100,000 worth of potash from this source annually.

The table printed on page 290 shows the results of the analyses of the different samples of ashes received from various country correspondents during the month of August in response to the request in the July (1915) issue of the *Journal* (page 19). Many of the samples were incompletely burnt, containing much carbon. On the other hand, many collectors had taken special pains to obtain a perfectly well-prepared ash, a work which has saved the analyst's time and rendered the results of greater value. On arrival at the laboratory the samples were heated in a muffle furnace in a free current of air at the lowest possible temperature, in order to avoid expelling any carbon dioxide, and at the same time to combust any free carbon. This, of course, altered the composition from the sample as received, and necessitated the compilation of a double set of figures, one representing the sample as received, the other the true ash. The latter, as obviously of more importance, is published; the former may easily be calculated (the loss on ignition being given) by those interested. The columns of monetary values are given from *unit values*. It must be pointed out that unit values do not necessarily represent market prices. It is, of course, open for any one who thinks the values are low to recalculate the values of the ashes for himself, using any values he prefers. The function of unit values is not necessarily to give the market price, but to afford a system by means of which fertilizers of different composition may be referred to a monetary standard, and thus be compared.

The disparity in the results of the analyses of the two samples of rata-ash is probably accounted for in the age of the wood burnt, young wood giving a high percentage and old wood a low percentage of potash. The amount of ash yielded by wood is, of course,

Laboratory No., 1915.	Name of Wood, &c.	Loss on Ignition (Carbon, &c.).	Analysis of completely burnt Ash.					Approximate Value per Ton.*	
			Potash (K_2O).	Phosphoric Acid (P_2O_5).	Equivalent to Tricalcic Phosphate ($Ca_3P_2O_8$).	Lime (CaO).†	Equivalent to Lime Carbonate ($CaCO_3$).	Sample as received.	Completely burnt Ash.
G.								£ s. d.	£ s. d.
234	Rimu (red-pine), (*Dacrydium cupressinum* Sol.)	7·96	3·10	0·88	1·92	37·68	67·45	1 19 6	2 3 0
274	Macrocarpa (*Cupressus macrocarpa*)	12·62	6·84	2·25	4·92	35·97	64·38	3 9 0	3 19 0
278	Manuka (*Leptospermum ericoides* or *L. scoparium* Forst.)	7·41	2·38	3·40	7·43	33·32	59·64	1 18 0	2 1 0
282	Rata (*Metrosideros* sp.)	5·16	8·28	1·63	3·56	20·58	36·83	4 1 0	4 5 6
285	Manuka (*Leptospermum* sp.)	22·96	1·39	2·06	4·49	30·50	54·59	1 1 0	1 7 0
287	Puriri (*Vitex lucens* T. Kirk)	19·72	2·70	7·28	15·92	28·04	50·19	2 2 0	2 12 6
288	Sawmill ash	7·89	5·88	1·13	2·47	17·09	30·59	2 17 0	3 2 0
290	Totara and rimu (*Podocarpus totara* and *Dacrydium cupressinum*)	4·72	14·37	1·68	3·67	34·61	61·93	6 18 0	7 5 0
292	Rata (*Metrosideros* sp.)	50·00	20·73	2·28	4·98	20·24	36·23	5 0 0	10 0 0
293	Kahikatea (white-pine), (*Podocarpus dacrydioides* A. Rich.)	31·99	13·93	2·68	5·85	10·59	18·95	4 12 0	6 15 6
294	Matai (black-pine), (*Podocarpus spicatus* R. Br.)	12·91	4·56	1·25	2·73	28·83	51·60	2 7 0	2 14 0
295	Maire (*Olea* sp.)	22·61	14·60	0·75	1·64	28·90	51·73	5 10 6	7 2 6
296	Monterey Pine (*Pinus radiata* or *insignis*)	28·32	0·12	2·57	4·62	10·05	17·99	0 7 6	0 10 6
297	Red-birch (red-beech), (*Fagus fusca* Hook. f.)	19·32	0·15	0·55	1·20	11·41	20·42	0 5 0	0 6 0
298	,, and matai	11·27	0·50	0·78	1·70	20·72	37·08	0 12 0	0 13 6
299	Bush-flax (*Astelia nervosa*)	3·72	23·27	3·27	7·10	23·25	41·62	10 17 0	11 5 0
300	Manuka (*Leptospermum* sp.)	20·29	5·42	2·41	5·27	23·55	42·15	2 10 0	3 2 6
303	Tawhero (kamahi), (*Weinmannia racemosa* Linn. f.)	6·86	8·27	3·53	7·71	27·60	49·40	4 5 0	4 11 6
306	African boxthorn (*Lycium Chinense*)	8·23	3·94	3·14	6·87	21·30	38·13	2 7 6	2 10 0
307	Manuka-roots from swamp	5·74	0·90	0·92	2·02	32·58	58·32	1 0 0	1 1 6
360	Heart of akeake (*Olearia Traversii*)	10·04	3·99	4·31	9·33	21·89	39·18	2 8 6	2 14 0
361	Houhou or whitewood (*Panax arboreum*)	23·63	2·70	4·84	10·48	23·62	42·28	1 14 0	2 4 6
362	Hokotaka (black akeake), (*Corokia macrocarpa*)	22·79	3·89	8·67	18·78	18·60	33·29	2 8 0	3 2 6
363	Karamu (*Coprosma* sp.)	8·98	7·08	6·04	13·04	21·08	37·73	3 18 0	4 5 6
364	Matipo (*Myrsine Urvillei*)	12·85	4·86	5·50	11·88	17·94	32·11	2 15 6	3 4 0
365	Koroheko (koromiko), (*Veronica* sp.)	11·41	6·96	7·33	15·87	17·66	31·61	3 17 0	4 7 0
377	Macrocarpa-cuttings (*Cupressus macrocarpa*)	8·79	6·96	2·64	5·71	26·14	46·79	3 11 0	3 18 0

* The values in the above table are derived from the following fertilizer unit values: Potash, 9s. per unit; phosphoric acid, 2s. 6d. per unit; lime, 4d. per unit.
† Carbonate, hydrate, and oxide of lime, expressed as oxide.

very small, and also varies with the age. Sawmill waste is not likely to yield more than 3 per cent. of ash.

Muriate of potash has recently been sold in America for £50 per ton, and it is said that £100 per ton has been asked in New Zealand. This would make the unit of potash cost approximately 20s. in the first case and 40s. in the second case. If the farmer cares to adopt such extravagant figures he may raise the 9s. standard adopted in this article, and if he is a vendor of wood-ashes he will have my hearty sympathy. Whether it will pay him to buy potash at these prices is a matter which cannot be decided without knowing the circumstances of each case. It is significant that the British Board of Agriculture (*Board of Agriculture Journal*, December, 1914), in its statement of unit prices of artificial fertilizers, has a blank in the price column for potash fertilizers. In a British trade journal of the 28th August it is stated that "there does not appear to have been any inquiries for potash materials, although some descriptions are known to be available at fairly high figures."

Indirect Substitutes.

Chief among substances which liberate potash from the soil-silicates, and which therefore may be looked upon as indirect potash fertilizers, is gypsum or land-plaster. Chemically this is hydrated sulphate of lime—a combination of sulphuric acid, lime, and water of crystallization. It is more soluble in water than either quick-lime or carbonate of lime, the other two salts of lime most commonly occurring in nature. When the water is driven off by heat at a temperature not exceeding 248–266° F., plaster-of-paris is formed. In the latter part of the eighteenth century the value of gypsum for leguminous crops, which are potash-lovers, became widely recognized. Benjamin Franklin is said to have sown gypsum so as to form the word "PLASTER" on clover crops by the way-side, in order that passers-by should learn by the eye what had so stimulated the growth.

Calcium sulphate in solution in the soil-water attacks secondary potash silicates (zeolites, &c.), liberating the potash, the calcium of the gypsum taking the place of the potassium. Boussingault's experiments with crops improved by gypsum showed on analysis an increase in the potash-content of the plant-ash, but no increase in the sulphur or lime content. Crops, such as the Cruciferæ — for instance, turnips, mustard, rape, &c.—requiring much sulphur, might benefit from the sulphur of gypsum, the main use of which is, however, as an indirect potash fertilizer.

Gypsum occurs in quantity in South Australia, whence it is obtained and largely used in New Zealand for diluting proprietary fertilizers. There are no known workable deposits in New Zealand. There is a seam at Macquarie Islands, which belong to Tasmania.

Some kinds of soft coal, notably that from Kaitangata, yield an ash which is largely sulphate of lime. Lime superphosphate, better known as "super," always contains a certain amount of gypsum, and it is the hydration of this which helps to dry the mixture after the sulphuric acid has been added. Sulphate of lime is contained in "gas-lime," the waste from gasworks containing the sulphur absorbed by the lime used in purifying the gas. After the waste has been allowed to oxidize, it contains up to 20 per cent. of sulphate of lime.

The continuous use of land-plaster without applying potash might ultimately lead to conditions in which the soil fails to respond to further applications of gypsum, but in the present state of the potash-market the use of sulphate of lime may be looked upon as a profitable expedient.

The following Ohio, U.S.A., experiments are quoted from Dr. C. G. Hopkins to show how gypsum may replace soluble potash salts.

AVERAGE CROP-YIELDS PER ACRE IN OHIO EXPERIMENTS.

Plot.	Treatment.	Maize (12 Years).		Wheat (11 Years).		Hay (8 Yrs.).
		Grain.	Straw.	Grain.	Straw.	
		Bush.	Tons.	Bush.	Tons.	Tons.
8	Yard manure and kainit	54·6	1·58	21·3	1·20	1·49
9	Stall manure and kainit	60·1	1·75	23·4	1·35	1·94
10	Nil	32·9	1·00	10·3	0·60	0·95
11	,, ...	36·8	1·17	13·1	0·81	1·30
12	Yard manure and gypsum	58·0	1·68	23·4	1·32	1·63
13	Stall manure and gypsum	60·7	1·78	23·3	1·31	1·65
14	Nil	31·6	1·00	9·9	0·57	0·85

Quantities applied were—Kainit and gypsum, 320 lb., plus 8 tons of yard or stall manure every three years.

The other commonly used compounds of lime—ground carbonate of lime, quicklime, and slaked lime—would also act in the same way as gypsum, liberating potash from the insoluble silicates, and having the additional merit of being able to neutralize soil acidity or sourness, which gypsum cannot do.

Common or agricultural salt or ground rock salt, the sodium chloride of the chemist, also has the property of being able to unlock potash from soil-silicates, as the Rothamsted experiments

clearly show. Salt is often an excellent dressing for mangel crops on soils which are not too heavy. It may also be used for potatoes, though it is said to make them waxy. Salt may be obtained in large quantities from South Australia. Magnesium sulphate will also liberate potash, but common salt and gypsum are cheaper.

An indispensable condition for the success of these indirect potash fertilizers is, of course, that the soil should contain potash silicates capable of being acted upon by the substances applied. Thus the Rothamsted experiments on a heavy clay soil, with sodium and magnesium sulphates on wheat, showed an increase which was comparable with that yielded by potash itself for the first twenty years, diminishing during the next thirty years, but always being superior to the control plot on which no alkaline salt was used. In the analysis of the wheat-ash the mixed sample from ten years' crops showed 4½ per cent. more potash in the alkaline salts plots than in the control plot, although the maximum on the plot treated with potash and alkali salt together was nearly treble that on the control plot.

There are some soils, such as those composed of quartz sand and deep humus soils resulting from the drainage of swamps, which exhibit an absolute deficiency of potash. On these soils potash cannot be liberated by indirect means, owing to the entire absence of insoluble potash compounds. In such cases the only remedy is to supply potash. It is hoped that experiments will be instituted to ascertain the value on New Zealand soils, particularly humus or peaty soils, of those insoluble potash compounds obtainable here. The mica-schist deposits of Otago and Westland, which occur in inexhaustible quantities and contain 3 per cent. of potash, already in a very finely divided condition, would seem to be a very promising source of potash to experiment with, but the other potash silicates* are also worthy of investigation.

* *Leucite* occurs in leucitophyres and allied rocks at Dunedin and in basalt near Castle Point. It contains 21·5 per cent. potash. *Muscovite* (white mica) occurs in many rocks. Large plates occur at Dusky Sound and at Charleston, Westport, where it was worked for a short time. Analysis by Liversidge showed 10 per cent. of potash. Muscovite normally contains 11·8 per cent. potash. *Alunite* occurs at Ohinemutu and Patua Ranges, and is deposited by geysers at Rotorua. It contains 11·4 per cent. of potash. *Orthoclase* (feldspar) is common as an important constituent of granites and other igneous rocks in New Zealand. *Sanidine*, a clear glassy variety, is very frequent near Dunedin in trachytes, bostonites, and trachydolerites. It contains 16·9 per cent. of potash. *Valencianite* (secondary orthoclase) is common in the veinstone of the Waihi and Karangahake mines. *Glauconite* is an abundant mineral in the "greensands" in the Gisborne, Hawke's Bay, Eastern Wellington, North Westland, North and South Canterbury, and North Auckland districts. It contains 8·12 per cent. of potash.

A FIELD EXPERIMENT WITH WOOD-ASHES.

On a small area of land at Marton Mr. Robert A. Wilson has conducted an interesting experiment with wood-ashes. A 12-acre paddock which had been cropped out and had previously borne a very poor rape crop had ashes from a sawmill applied throughout the year. These ashes had been quenched, and probably contained 30 per cent. of water. Altogether 3 tons per acre was applied. Rape was sown in November, 1914, a splendid crop being the result. The 12 acres carried 350 lambs, of which 250 were fattened. Some of the lambs were poor when they came on, and fattened splendidly. The ashes cost for haulage, railage, and distributing £1 per ton, and were applied at the rate of 3 tons per acre, thus costing £36. The gross profit on the lambs was £90, of which at

WOOD-ASHES AS A FERTILIZER.—CROP OF MUSTARD.

least £50 was due to the extra crop grown by the application of the ashes, which thus more than paid for the application in the first season. The soil has been, in addition, vastly improved by the large amount of phosphate and carbonate of lime in a very fine state. The effects of the lime will last, no doubt, for many years. The illustration shows sheep being fattened on the aftermath of the same crop in September, 1915, eleven months after the crop was sown. The analysis of similar ashes in the dry state from the Rangataua sawmills shows 2·85 per cent. potash, 0·82 per cent. phosphoric acid, 62·07 per cent. carbonate of lime. These figures would have to be diminished by one-third as the result of the quenching.

A more interesting experiment was carried out on a small adjoining paddock of three-quarters of an acre, which three years

ago had 10 tons of sawmill ashes, and last year an additional 5 tons of wood-ashes and 3 tons of carbonate of lime, applied. On this paddock 10 lb. of mustard-seed was sown on the 27th April, 1915. The accompanying photograph was taken on the 9th September, 1915, when the crop was in full flower. The crop was thus grown during the four months of winter, and at date of writing is ready to feed

ANOTHER VIEW OF THE MUSTARD CROP.

off or plough in for green manure. The growth is one of the most remarkable ever seen in the district, and the yellow flowers can be seen from the Marton Railway-station, showing well above the fence, which is over 4 ft. high. Very few people realize what small quantities of fertilizers will produce if supplemented by large amounts of carbonate of lime, as sufficiently demonstrated by these two instances.

WOOD-ASHES AS A FERTILIZER.—SHEEP FEEDING ON AFTERMATH OF RAPE CROP.

[*Photos by B. C. Aston.*

(TO BE CONTINUED.)

RINGWORM.

H. A. REID, F.R.C.V.S.

RINGWORM, a skin-disease which has been very prevalent among horses during the past winter, is caused by a vegetable parasite composed of innumerable minute bead-like bodies or spores analogous to a mould. It attacks the roots of the hair in patches, the spores invading the hair and totally destroying it.

The disease is highly contagious, and may be conveyed from one animal to another by direct contact or through the medium of grooming utensils. Infection may also be spread through animals rubbing themselves against trees, fencing-posts, or similar objects which have been used for the same purpose by other animals affected with ringworm. In certain cases it is impossible to decide how contagion has taken place, and it seems reasonable to suppose that flies or other winged insects may be capable of conveying infection from diseased to healthy subjects. The spores of ringworm may also be carried for considerable distances by the wind.

Several varieties of ringworm have been described, but it is unnecessary to enumerate these in an article intended solely for general information. The essential features of the various forms of the disease are practically identical in the cases usually met with. Ringworm affects principally young animals, but it may be seen in horses of any age, especially during the winter, when the heavy coat encourages a dirty condition of the skin, and, moreover, helps to mask the appearance of the disease in the early stages. Horses and young cattle in poor condition, with long dirty coats, are especially prone to infection.

Ringworm generally attacks the parts which are more liable to rubbing and friction, such as the back in saddle-horses, sides of the neck, around the girth, and the quarters. The parts chafed by cover-straps are also frequently the seat of disease. In calves and young cattle the head and face are commonly affected.

The earliest symptom of ringworm is a small raised spot, which may be felt but cannot as a rule be seen even in a clipped coat. About three days later this spot becomes a raised patch about the size of a sixpence, but the hairs are not shed until a few days later. In the later stages the lesions present the appearance of

hairless circular patches varying in size from a sixpence to a half-crown. Sometimes these may be confluent or extending into each other, thus greatly increasing the area of the patch.

TREATMENT.

Treatment comprises prevention of contagion, separation of the affected from the healthy, and the individual treatment of cases. Beyond taking care that no visibly affected animals are introduced among clean stock, and that horses or other susceptible subjects are maintained in good condition, little can be done to prevent

After M. H. Hayes.

HORSE SUFFERING FROM RINGWORM.

an outbreak of ringworm. As a rule the disease makes its appearance without any warning. One or more animals are found to be affected, and unless energetic measures are resorted to the trouble rapidly spreads. Ringworm may be present in heavily coated horses, and for a time pass unrecognized. Not until the hairs have fallen off or been removed by grooming or other friction is the presence of the disease noticed. By this time infection has probably been conveyed to other parts of the body and to other horses by means of grooming untensils, harness, or covers.

All animals found to be affected with ringworm should be separated from those appearing free from the disease. The best

plan in regard to horses is to picket them to a line in the open while under treatment, as if they are allowed to run loose they will spread the disease among each other, and also leave possible centres of reinfection upon the trees, fencing-posts, &c., in the paddock.

The appearance of ringworm in any degree among horses should entail the complete clipping of the affected animals. Unless this be done the extent of the infection cannot be recognized, nor can curative treatment be efficiently carried out. Needless to say, clipped horses will have to be kept rugged or covered except during the warmer part of the day. Covers should therefore be marked with a distinguishing mark, so that they may be used for individual horses. They should be thoroughly brushed and washed with disinfectant solution every week. When possible, the covers should be exposed to the sun to dry.

The clipping-machine has a tendency to spread the disease by direct contact, and also on account of the scurf and hairs from affected patches falling on other parts of the body. This drawback can in some measure be guarded against by applying over the affected areas, previous to clipping, a little of the ointment recommended for treatment, and wiping the coat all over with a cloth slightly greased with the ointment or wrung out in kerosene. Clipping should always be done in the open, and the hairs and debris collected and burned.

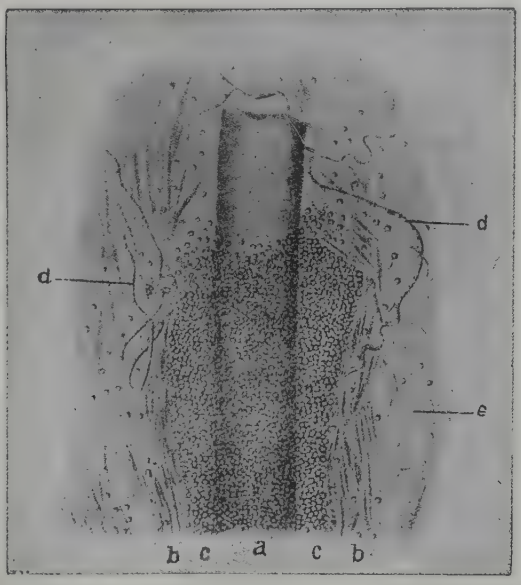
The dressing which has proved most efficacious in our hands is composed of a mixture of 1 part white precipitate (ammoniated mercury) to 2 parts of lard. Another preparation which may be used consists of carbolic acid 1 part, lard and soft-soap of each 20 parts. Failing either of these, an application of 1 part of tincture of iodine to 9 parts of methylated spirit will be found reliable. This is applied to the bare patches by means of a stiff brush.

In the case of calves, owing to the habit these animals have of licking each other, it is advisable to refrain from the use of poisonous applications. In such cases tincture of iodine and spirit in the proportions named will be found generally suitable.

In applying the ointment to a horse the animal should be felt over, and any suspected spot, ringworm or otherwise, should be dressed. Raised patches may be detached if they will come away easily; if not, they are simply dressed with the ointment, which is left on until they readily peel off. Daily examination for fresh spots has to be made—the dressing of the day before being gently replaced to the skin, as it tends to work up on the hair. The

application of the ointment should be continued to the apparently healthy parts immediately outside the diseased area, in order to check extension of the process. Cases of ringworm should not be considered as cured until ten days after the disappearance of all suspicious symptoms.

All stable utensils, harness, stable walls, and any articles or objects liable to convey infection should be washed with hot water and soda, and then wiped over with a cloth dipped in a solution of kerol or similar disinfectant in proportion of 1 part to 20.



After Hutyra and Marek.

MICROSCOPIC APPEARANCE OF HAIR ATTACKED BY RINGWORM (X 200).

(*a*) Hair. (*b*) Remnants of a hair-sheath. (*c*) Fungous mantle round the hair. (*d*) Fungous filaments. (*e*) Skin-cells.

Stable walls may be limewashed or sprayed with the disinfectant. It should be borne in mind that ringworm of animals may be contracted by man. Attendants should therefore carefully wash their hands in disinfectant solution after handling affected animals, and should take care not to rub their arms or face before cleansing their hands in this manner.

CALIFORNIAN THISTLE RUST.

A. H. COCKAYNE.

For some years past it has been noticed that the Californian thistle rust (*Puccinia suaveolens*) has increased considerably amongst these thistles in many parts of New Zealand, and it is now quite generally distributed. In certain localities its effect in reducing the vigour and subsequent development of the weed has been quite marked, but in certain instances, although the fungus has been present to a large extent for some seasons, there is no diminution in the spread of the thistle. In general, however, whenever the percentage of affected shoots is greater than that of healthy ones a rapid thinning-out of the patches takes place. On the other hand, the presence of only a small proportion of affected shoots does not appear to exert any appreciable effect. Again, in certain localities patches badly affected during one season appear to partially recover in the next, and for this reason the efficiency of the rust as a controlling agency in the spread of Californian thistle has been doubted by many observers. When, however, it is recognized that a plant producing diseased shoots remains permanently affected until the ultimate death of the plant, it is clear that if once all the underground portions of a patch become affected, then the whole patch will succumb more or less rapidly.

Such being the case, the problem that presents itself is how complete infection can be secured. In those instances where the rust apparently disappears after considerable infection has taken place the healthy development that follows is not because the disease has been shaken off, but is due to the affected portions having died out before the complete infection of the remaining healthy plants takes place. Thus for the rust to become an adequate means of control it is necessary to increase infection considerably beyond that occurring naturally, and the feasibility of applying artificial aids towards furthering infection commands attention.

During the past three years a considerable amount of study has been given towards devising practical methods in this direction. The results of the experiments carried out in this work have by no means been invariably successful, but during the

investigation a more complete knowledge of the life-history of the fungus has supplied a full explanation why both positive and negative results have been secured. Before detailing the methods that have given the most satisfactory results it is necessary to sketch briefly the life-history of the fungus, as this has a most important bearing on the whole question of artificial inoculation.

LIFE-HISTORY OF THE FUNGUS.

If a diseased patch of thistles is examined about the month of October, there will be seen amongst the normally developing shoots a number so essentially different in appearance that they can be immediately recognized. These abnormal shoots are characterized by a sickly greenish-yellow colour, and possess thick hollow stems, while the leaves point upwards and do not spread out from the main stem. When these leaves are examined they will be seen to be covered with pustules that soon burst and emit large numbers of chocolate-coloured spores. The pustules are often confluent, and may at times almost entirely cover the under-portions of the leaves. These spores, termed "uredospores," are developed from the mycelium of a fungus belonging to the rust family, called *Puccinia suaveolens* Pers. The mycelium producing the spores permeates the whole of the tissues of the diseased shoots and vegetates permanently in the underground stems themselves. The shoots produced from stems containing the fungus are always diseased, and although they may grow for some time they invariably wither away without producing any flowers, while the fungus, gradually exhausting the food resources of the underground stem, causes the whole plant to gradually succumb.

The uredospores are blown about by the wind, and are able to germinate on the leaves of healthy thistle-shoots, provided the latter are not too old and there is an abundance of moisture. After germination the tissues of the leaf are penetrated, and a small temporary mycelium localized in the leaf is developed. This mycelium then developes pustules well separated from one another in which, in the first place, a second generation of uredospores is developed. These uredospores appear incapable of causing infection under normal conditions, and their function is not properly understood. However, in the early autumn the pustules giving rise to these spores produce a quite different type of spores, darker in colour than the uredospores and two-celled. These spores are termed "teleutospores." After a period of rest they produce in the spring a mycelium composed of a single filament on which small colourless spores are developed. These colourless spores cause the infection of the young spring growth of the thistle,

and rapidly produce a downward-growing mycelium that finally enters the underground stem and causes a malformation of the affected leaves. Any fresh shoots that are developed after this infection has taken place are of the type first described, and thus the full life-cycle of the fungus is completed.

METHOD OF INOCULATION.

From what has been written as to the teleutospores alone producing the permanent type of mycelium that ultimately causes the death of the thistles, it would appear as if inoculation with the spores (uredospores) producing only the temporary mycelium should not be followed. However, unless a preliminary inoculation with uredospores from diseased shoots is carried out it is found exceedingly difficult to collect teleutospore material in sufficient quantity. Thus double inoculation is necessary in order to secure good results.

A quantity of diseased shoots in which the uredopustules are emitting spores should be soaked in water for about half an hour, and the material constantly agitated so as to release the spores into the water. The water containing the spores should then be sprayed on young healthy thistles with a spray-pump provided with a Bordeaux nozzle. After about fifteen days the small brown second-generation uredopustules will have commenced to develop. In the autumn, just before the leaves begin to wither away, the development of teleutospores will have been about completed, and the affected leaves should be collected, dried, and kept till the early spring. The leaves should then be crushed up and soaked in water in order to liberate the spores, after which the water containing the spores should be sprayed on to the young growth of the thistles in a similar manner to that previously described for the uredospores.

In the earlier series of experiments spraying with uredospores only was carried out, and the varying success secured was due to natural infection with teleutospores occurring in certain cases and not in others. Of course, infection with uredospores alone, if carried out on a large scale, will greatly increase the possibility of further teleutospore infection, but it is clear that it cannot give the results that are certain to follow by the employment of the spores producing the permanent type of mycelium. The spreading of affected material over healthy patches of thistle has been carried out in certain parts of New Zealand, and at times has been followed with good results, but its success is dependent on whether the natural conditions are afterwards favourable for teleutospore infection.

CELLAR HYGIENE AND MANAGEMENT.

HINTS TO WINEGROWERS.

A. H. MAZURE.

THE writer, who has just returned from a visit of inspection to the majority of the vineyards and cellars of the North Island, naturally observed many things, and, judging from these observations, the following hints should not come amiss to the vigneron who is also the proprietor of a wine-cellar.

CLEANLINESS.

The first and most essential thing in winemaking and in the management of a cellar is absolute cleanliness. The impression that a visitor gets when he sees a well-kept, well-ordered, and clean cellar is always a good one; it conveys to him the idea that the product of that particular establishment must be good. If, on the other hand, the place is dirty and ill-kept, the impression obtained is not by any means a good one. What person would like to think of buying milk or cream from a dairyman who works in a dirty cow-byre, and whose cows are milked by a dirty milker? The same thing applies to the winemaker.

To begin with, pick up all the stray bungs and chocks, and pack them away tidily in a handy box. When there is an overflow on to the floor clean it up at once. Dry wines, and especially the young and fairly aged wines, are very susceptible to innumerable diseases, and this is generally the way the trouble commences: The mess on the floor is not cleaned up; the buckets and tubs are not washed after being used; the hose which is used for drawing off wine is hung over a cask to drain, but rarely washed out. Wash everything always and every time it is used, and do not forget the pump. It does not take long, and will save time and endless worry. If this is not done the wine will later on probably become cloudy, and there will be a great difficulty in clearing it; perhaps it will not clear at all, and the vigneron actually wonders why.

Another point: when there is an overflow do not let the wine dry on the cask. When racking, have a bucket of water handy with a handful of ordinary washing-soda in it—or, better, a little

caustic soda—and wash the top of the cask. The soda will neutralize the acidity of the wire, and also act as a check against the acetic germs (*Mycoderma aceti*).

Do not use bung-cloths; avoid them as you would the plague. When once wet with wine they will become sour. This means contamination of the contents of the cask.

Do not be afraid to use lime in the cellar. If there is a peculiar smell about the place that is not appreciated, sweep the cellar out and sprinkle some slaked lime all over the floor, and the odour will very soon disappear.

When cask-washing do not throw the washings just outside the door; in the summer the resultant stench is abominable. If there is no drain, make one, and sweep it down occasionally and lime it.

HOW TO MAKE A CASK AIRTIGHT.

In many cases, after the vigneron has taken a sample from a cask he furiously hammers in the bung with a mallet or hammer. He believes he is making that cask airtight. He certainly may make his cask airtight, but at the same time he is ruining the staves and the bung-hole, and he will find this procedure an expensive one. If he acts as now described he will not go wrong: Render down 7 lb. of *unsalted* mutton-fat. When this is boiling add 7 lb. whiting powdered as finely as possible. Boil together for five minutes, then melt 1 lb. of good beeswax and pour it into the mixture, stirring thoroughly. Pour the whole compound into a suitable receptacle (an ordinary tin dish will do), and stand it in a cool place. Next day it will be set hard.

When it is necessary to bung up a cask and make it airtight scrape off as much of the fat-mixture as can be conveniently held in one hand. Work it up under cold water until it becomes about the consistency of putty. Tap the bung *lightly* into the cask with the hand, and press the mixture in all round it. If this is carried out properly the cask is airtight; there is no damage done, no searching in dark corners for the bung-starter or the hammer, no needless swearing; for when it is necessary to open that cask again a tap of the hand on the bung and it comes out quite easily.

The above preparation is used practically everywhere throughout the winemaking countries of the world, and is very highly recommended. It has practically no taste or smell, and it has no effect whatever on wine of any description. It can be used many times over. Paraffin-wax for this purpose is absolutely useless; it cracks, and is very much more difficult and troublesome to apply.

SULPHURING.

When a cask of dry wine is ullaged burn a tiny piece of sulphur match in the cask over the wine. Bung the cask up airtight in the manner already described. Do this every time the cask is drawn from, and the wine left will keep perfectly sound until the cask is emptied. The sulphur matches can be made by any one: Take a strip of calico 2 in. or 3 in. wide, dip it into melted sulphur, and hold it out to dry (it dries almost immediately). Be sure to wash the lime out of the calico before making the matches. Be careful when sulphuring that the match is not shaken off the wire into the cask, or one will be inclined to wonder how that obnoxious taste got into the wine.

Never sulphur casks after washing until they are perfectly dry. I have tasted what would have been excellent wine had it not been racked into a wet cask freshly sulphured.

METHOD IN THE CELLAR.

In arranging the casks in the cellar, have all the dry white wines together, all the dry reds, the sweet whites, the sweet reds, and so on. Do not have a cask of port here, one of claret alongside, and then a sherry. It means innumerable chalk-marks on the heads of the casks, and leads to endless confusion.

When wine-tasting do not start off with a sweet red and then taste a dry white. Take them in order, commencing with the light dry whites, then the light dry reds, winding up with the sweet wines.

Many of the above points may appear trivial, but after all it is these little things that count.

INSPECTION OF GRASS-SEED PADDOCKS.

AT the last annual Dominion Conference of the New Zealand Farmers' Union a motion was passed to the effect that wherever desired the Department of Agriculture should inspect grass seed paddocks and issue certificates as to their cleanliness—*i.e.*, freedom from noxious weeds such as ragwort and Californian thistle. It has now been decided by the Department that in cases where a request is made for this service it will arrange for the inspection to be made and for a suitable certificate to be issued, provided the inspection is asked for in time to be made immediately prior to the harvesting of the seed. If, however, any considerable number of requests for inspection are received the question of charging a fee for the service will have to be considered by the Department.

FARM DRAINAGE.

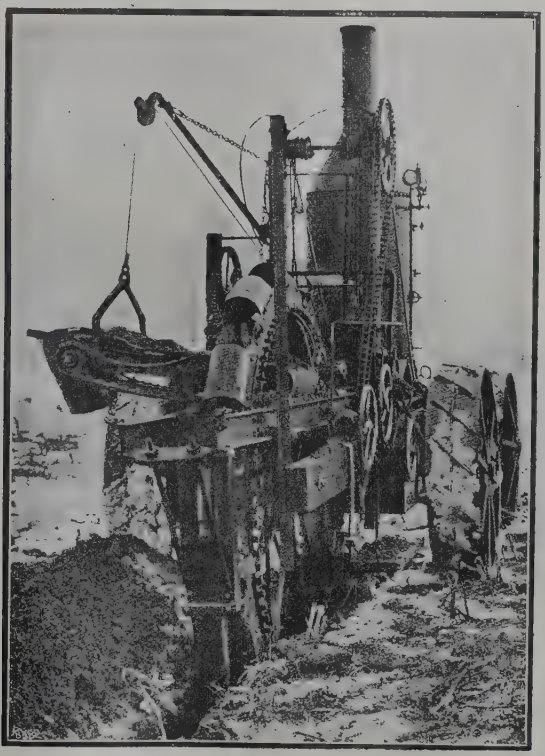
CONCLUDED.

A. McTAGGART, M.S.A.

LABOUR-SAVING MACHINERY.

THE digging of drains entails a great deal of labour, especially on refractory soils. The substitution of mechanical ditchers for hand labour is therefore not unwelcome. In Ontario and elsewhere in North America the advent of traction ditchers has practically revolutionized tile-drainage operations. These machines, which are self-propelling and of various sizes, are capable of digging a ditch from a few inches to 4½ ft. deep and from 25 to 35 chains in length in an ordinary working-day. The earlier machines were propelled by steam, but the latest ditchers have gasolene-engines. They handle soils with stiff subsoils and stones up to 1 ft. in diameter, but not hard cement subsoil formation nor rock. Stumps, of course, form an obstacle to their use, but where buried tree-trunks are encountered these may be severed or dug out by hand, to permit the continuance of the mechanical excavation. The machines have broad-rimmed wheels, and the later ones are fitted with caterpillar or endless belt or apron arrangements of broad dimensions (see illustrations). Where an empty wagon and a team of four horses will sink into a swamp these machines will traverse the surface. The smallest-sized machine (capable of cutting a ditch 11½ in. wide and anything down to 4½ ft. deep) costs in America about £240. Landed in New Zealand this would cost about £300. The machines are manufactured by the Buckeye Traction Ditcher Company, of Findlay, Ohio, U.S.A. For digging open ditches with dished sides and of varying depths the company manufacture much larger machines. These are specially designed for large drainage operations such as the reclamation of extensive swamp lands, also for digging irrigation-canals. The machines designed for tile drainage that have been supplied by the company for use in Canada have certainly done and are doing excellent work, and have undoubtedly proved their great labour-saving capacity and economy. In localities where much land is in special need of drainage and stumps are not numerous co-operative purchase of ditching-machines by farmers is well worthy of consideration.

The method of operating these mechanical ditchers for digging to a prescribed grade along a course over which the levels have been previously taken is as follows: At various known distances long poles, which are coloured red, white, and blue in 1 ft. sections, are set up. Pieces of red braid are tied to these at definite heights, the line of red tags forming the grade corresponding to



BUCKEYE TRACTION DITCHER FOR TILE DRAINAGE (STEAM-ENGINE).

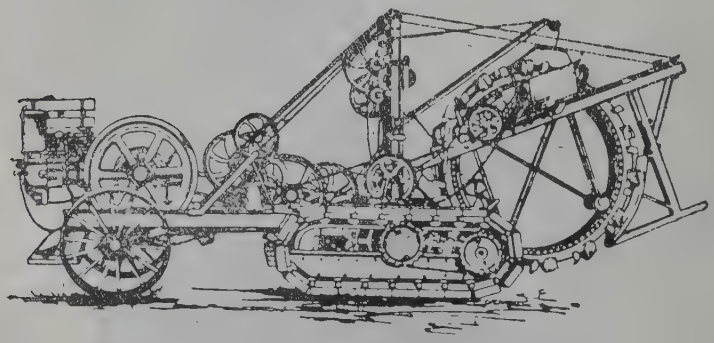
that required for the ditch-bottom. The machine is set in position at the required depth on the proposed ditch-line, usually at its lower end. The operator stands on a low platform on the ditcher and holds in his hand a hand-wheel similar to that on a traction-engine. This he moves backwards and forwards, thereby raising or lowering the excavating-wheel at the rear of the machine. On the fore part of the ditcher is a sighting-arrangement which, by

movement of the hand-wheel, he keeps in line with the series of red tags attached to the poles. By so doing a trench of required grade is excavated as the machine proceeds.

Some of the trenching-machines undertake in addition to lay the pipes along the bank of the ditch, from which position they can be readily placed firmly in position by means of the rod referred to in the previous article. For quickly filling the trench a scoop is used.

THE MOLE PLOUGH.

A reasonably cheap and effective method of draining land—especially pasture land with stiffish clay subsoil—and one that has given specially marked results in the South, is that of making use of the mole or drain plough. As will be noticed by the illustration,

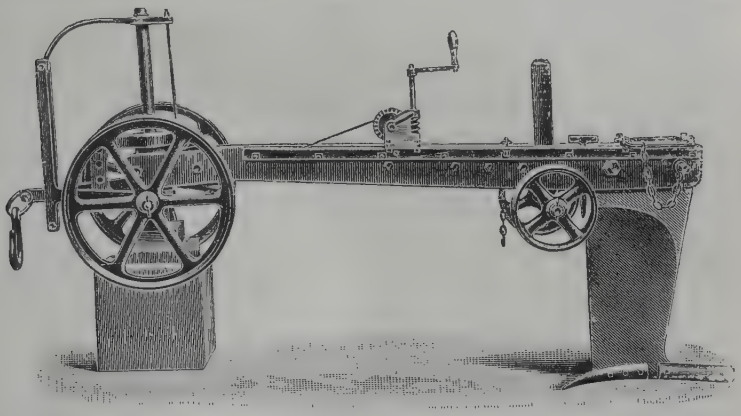


BUCKEYE TRACTION DITCHER.
Later type, with gasolene-engine and caterpillar arrangement.

this implement consists of a plate at the foot of which is a mole or cylindrical piece of steel which, when drawn through the soil at a regulated depth, leaves a channel through which the water flows. The plough may be drawn by eight to twelve horses or by a traction-engine. A traction-engine is also sometimes used as a winch to pull the mole plough through the ground by a wire rope on the drum. With this method, after the plough is hauled up to the engine it is lifted out of the ground and then dragged back to the other end, with the rope attached, by a couple of horses. The engine meanwhile is shifted along to the required position for the next drain, and the plough is again pulled up, this operation being repeated until the work is completed. Under certain conditions, such as very wet ground in a field, this system may possess advantages over ordinary haulage.

The depth at which the channels are usually set varies from 2 ft. to 3 ft. The channels may be run parallel and fairly close together, and into an open ditch, or on the herring-bone principle as with the pipe system, the main channel following the course of a more or less natural depression in the field. Near the junctions the laterals, as in the pipe system, should receive a bias in the direction of the water-flow in the main. In the case of orchards the mole channels are run half-way between each two rows of trees and down the slope.

The foothill slopes of pastoral land could in many instances be mole-ploughed, the channels descending not straight down the slope, but gradually, at an angle. These could be connected with pipe drains on the adjoining flats, or with a further system of mole channels if the subsoil is suitable. In stiffish clay subsoil the



MOLE PLOUGH.

channels remain intact for some years. Where considerable seepage from the hillside obtains it would be advisable to cut it off by means of a fairly deep trench, and run the mole channels into this. The adjoining flat would then require to be dealt with in an independent system of drainage, either by mole plough or by drain-pipes. The water collected from the hillside could, of course, be directed along an open ditch, or one of the larger pipe drains forming part of the system put in on the flat.

SPECIAL DRAINAGE PROBLEMS.

One of the most prominent problems in drainage of farm lands and one that is not often recognized is that last referred to—the drainage of flat land adjoining which is a hill from which seepage

takes place, due to springs or the geological formation and plenteous rainfall. The seepage is cut off at the base of the hill in the manner indicated, the flat land being then in a position to be effectively and economically drained. The same principle applies to a swamp surrounded by sloping land or hills. The swamp is a catchment basin for the water from such slopes, hence trenches at the bases are necessary to ensure the effective drainage of the swamp.

Where a creek or creeks enter a swamp, thus constantly supplying it with water, drains should be cut in the most convenient parts of the swamp to connect with the creeks. By digging drains through the shallowest swamp material and connecting these with the inflowing streams, also by partial draining of the deeper swamp, the area ultimately dries and settles sufficiently to permit and justify deeper, hence effective, drainage.

Peat swamps, which are invariably deep, should be drained gradually, so as to permit of settling, leading to consolidation and retentiveness. If a peat swamp is drained too deeply at the outset, it dries out readily and settles with difficulty. The swamp remains open, and hence the natural flow upwards of water from below (capillarity) is interfered with. Thus crops grown on the surface of such soil will not obtain sufficient water, and so cannot thrive. The drying-out of the swamp by premature deep drainage encourages fires which, when permitted to spread through the swamp, to a large extent destroy the dormant yet valuable fertility of which the area is composed. Thus, in the drainage of peat swamps shallow drains, deepened, say, every two years, are not only advisable but essential. Because of the neglect of this principle, mainly unwittingly, areas of peat swamp in parts of the country have practically been ruined. The shallower swamps are the most valuable, more especially if they are underlaid with clay, which material when dug out of the drains should, where possible, be incorporated with the peat to give it body, retentiveness, and mineral substances. Indeed, the carting on to the peat and incorporation of clay, where feasible, is treatment to be recommended.

Where quicksand or specially loose subsoil that is likely to wash is encountered when putting in tile drains, boards half an inch in thickness are usually laid under the pipes to support them. In the event of the excavation penetrating such formation, wooden fluming is usually inserted where the drain traverses the quicksand, and is connected up neatly with the piping. Open drains have frequently to be similarly protected by wooden fluming or boxing of larger construction.

Pipe drains in fine soils frequently require silt basins at certain points to collect the silt carried in suspension by the water, and thus prevent the drains from ultimately becoming choked. In such soils where the ground is specially loose a basin is usually inserted in the pipe line. Such a basin can be made by insetting a wooden or cement box and placing the lower or continued stretch of tile a little lower than those first laid. This arrangement collects the silt and at the same time keeps the subsequent stretch of tile clear for a given length. Had the two stretches of pipes been placed directly opposite each other the pipes would again soon become blocked as the silt-box filled. Of course the basin requires to be occasionally cleaned out with a shovel.

Where surface-drainage only is desired—though this does not eliminate waterlogging and is by no means so conducive to crop-production as systematic under-drainage—it can be provided by ploughing the soil in lands, thereby leaving it in strips high in the centre and furrowed at the sides. Land to be laid down in grass for some years profits by such ploughing

Open ditches are increased in effectiveness and land farther back is improved in its drainage properties by systematic cleaning. Grass and weeds should be periodically cleared from farm ditches when there is nothing pressing in connection with the work of the farm. This will react on the general drainage, therefore productiveness, of the whole place. This is a fact which is overlooked or not fully appreciated on many a New Zealand farm.

CONCLUSION.

In conclusion, it may be urged that more and effective drainage should be prosecuted vigorously, where at all feasible, in New Zealand, for it is required to increase the productiveness of the country. Together with judicious liming, there is nothing that will accomplish this desirable result more quickly and effectively.

A NEW ZEALAND DITCHING-MACHINE.

J. BROWN, B.Sc., N.D.A.

THE cost of draining farm land in New Zealand has often been prohibitive of such operations except by partial expedients of limited application, such as the mole plough. In America, as described elsewhere in the *Journal*, ditching machinery has been introduced, and is being successfully used in connection with

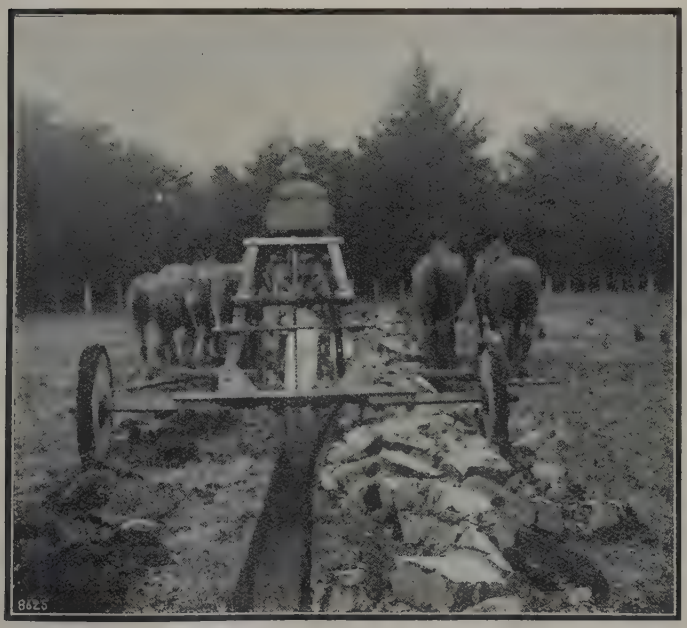
tile drainage, &c. It is therefore pleasing to record the advent of a New Zealand invention, the Armour-Johnston ditcher, manufactured by the Invercargill firm of Armour, Johnston (Limited). Judging by what it has already accomplished, it looks as if this machine will be proved in extended practice worthy of a high place among the achievements in agricultural engineering for which New Zealand is noted.

The essential feature of the machine is an excavating-wheel, of width according to width of ditch desired (usually 10 in.). Beyond the edges of this wheel steel flanges or skeiths project

THE ARMOUR-JOHNSTON DITCHER.—DEMONSTRATION AT RUAKURA.

for 6 in., providing for the removal of a 6 in. cut at every passage of the machine along the trench. The wheel revolves on an axle running in bearings securely attached to a channel steel framing. On the same framing and behind the excavating-wheel a leg is riveted, with a renewable sock at its end. The point of this sock occupies a fixed position between the skeiths at bottom and just about in a vertical line with the centre of the axle. On the top of the excavating-wheel is a scraper which removes the earth from between the flanges and delivers it on to a chute which can be tilted to deliver on either side of the ditch. The front end of the framing is carried on a swivel

wheel with bridle and tug-chain attached. This wheel runs in the ditch after the first cut and guides the machine. The rear end of the machine is carried on a steel gantry hinged to the main frame, and provided with a winding-drum and gearing for lowering and raising the machine into and out of the cut. As the machine is drawn forward the skeiths make the side-cuts and the sock makes the under-cut, at the same time compressing the material between the flanges. The material then



REAR VIEW OF THE DITCHER, SHOWING WORK.

travels round with the wheel till it reaches the top centre, where it is taken off with the scraper and dropped on to the chute, which directs it to the ground. The machine costs £110.

A demonstration of this machine was given before a number of interested farmers at the Ruakura Farm of Instruction last month. The soil in which the trenches were cut would be described as a loam with a close-textured subsoil. At the time of the trial both soil and subsoil were saturated with water. As the photographs indicate, the machine did the work well,

making a clean cut to a depth varying from 2 ft. 6 in. to 3 ft., and 10 in. wide. When steadied down to the work a good team of eight draughts did not make hard work moving the machine forward at a reasonable pace. Trenches averaging 7 chains in length and about 3 ft. in depth were cut out at the rate of 20 chains per hour. With longer lines of drain this rate would, of course, be exceeded. A few stumps were encountered, and these the machine overrode without difficulty. Partially decayed timber up to 6 in. in diameter was cut through by the skeiths. It appeared that the machine would be effective in trenching any soil of sufficient coherence, when compacted by the weight of the machine, to travel up the excavating-wheel. This condition would apply to practically all soils in which drainage is required. The machine could be used for a complete system of trenches for tile drainage or for cutting mains into which mole drains could be led.

A trial was made with a motor-tractor in place of horses for hauling the machine, but without success, as the wheels failed to grip in the slippery material excavated from the trench. This could be remedied by extending the delivery chute so as to deposit the material beyond the reach of the wheels. It is probable, however, that in most cases the passage of the tractor-wheels up and down the edges of the trench would cause them to break away.

AGRICULTURAL STATISTICS.

PENDING the introduction later in the season of complete machinery for collecting agricultural statistics, the return of the area sown or to be sown in the more important crops is again being taken through the post. The co-operation of occupiers in securing a full and reliable return is earnestly sought, the matter, under present conditions especially, being of national concern. Accurate particulars of the areas under crops are, of course, essential in the compilation of reliable statistics of total production, the importance of which has been markedly demonstrated during the past year as regards wheat and oats. The area under wheat this season will be an important factor, moreover, in determining what special arrangements for providing labour in connection with the harvest will be necessary. Questions of embargo on exports must also be largely governed by these statistics. Every grower of crops is therefore urged to make a return. Occupiers who have more than one acre in any one crop and who do not receive a form should apply for one to any district office of the Department of Agriculture. The return is being taken in October for the North Island and in November for the South Island.

WEEDS AND THEIR IDENTIFICATION.

CONTINUED.

E. H. ATKINSON.

DANDELION (TARAXACUM OFFICINALE).

General Description.—Dandelion is a perennial herb with a thick rootstock, which often descends several feet into the soil. The root is of a brown colour outside, but is white inside, and is full of a milky juice which is present also in most other parts of the plant. This rootstock may be crowned with a single rosette of leaves, or it may be divided above into several branches each with its rosette. This tendency to branch is increased when the plant is cut off below the crown, a fact which renders dandelion difficult to eradicate.

The leaves are all radical, and are extremely variable in size, proportion of length to breadth, and in the degree to which they are cut or lobed. The average length is perhaps 5 in. and the breadth 1 in. The general shape of the leaf is oblong, but it is usually widest near its apex and tapers more or less suddenly towards the base, though often this general outline is disguised by the fantastic cutting of the margins. The series of leaves shown in Fig. 2 will give a better idea than any description of the variation that occurs in the lobing of the margins. It may be stated, however, that the lobes are usually pointed and have their tips directed towards the leaf-base. The colour of the leaves is rather bright green, but there is often a glaucous or bluish tinge. The midrib is conspicuous on both surfaces owing to its colour, which may be pale or in some specimens purplish red. The leaves are most often quite glabrous, though there are sometimes a few light-coloured hairs on or near the midrib, particularly on very young leaves.

The flower-heads are borne singly on rather stout, smooth or slightly cottony, hollow stalks, on which there are often one or two deeply cut bracts. Plants with light-coloured midribs usually bear pale-green flower-stalks, while those with purplish midribs have their flower-stalks tinged with purple too. The involucre consists of two rows of bracts; those of the innermost row have their edges touching, and form a tube for part of their length, and then

FIG. 1. PLANT OF DANDELION, SHOWING FLOWERS AND SEED-HEADS. RATHER LESS THAN HALF NATURAL SIZE.

FIG. 2. LEAVES OF DANDELION, SHOWING VARIATION IN OUTLINE. ABOUT ONE-THIRD NATURAL SIZE.

spread out beneath the expanded rays of the head. The outermost bracts are much shorter than the others, and, being variously twisted and recurved, form a sort of irregular crown at the base of the involucre. The bright-yellow florets are all ligulate (or strap-shaped), and when fully expanded form a head about 2 in. in diameter.

After fertilization has taken place the inner bracts close in round the young achenes, forming a cone which is tipped with the shrivelled remains of the florets. When the fruit is ripe the bracts curve right back till they touch the flower-stalk, and the whole head of achenes, each with its spreading pappus, becomes globular in shape, forming a "dandelion clock." All these stages of flower and fruit are shown in Fig. 1. Each achene is about $\frac{1}{8}$ in. long, greenish-yellow in colour, rather flattened, and marked with ribs which are spiny towards the upper end of the achene. There is a long slender beak crowned with a very delicate white pappus. The hairs of the pappus are not downy as is the case with those of catsear, though under a strong magnifying-glass they appear rough.

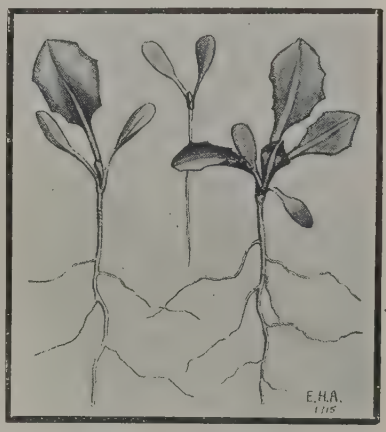


FIG. 3. DANDELION.
Seedlings of three different ages. About natural size.

Seedling.—The seedling of dandelion bears two oblong seed-leaves which are rounded at the tips and taper rather abruptly into the leaf-stalk. These first leaves differ from those of catsear in being broader in proportion to their length and in being less sharply pointed. The succeeding leaves are much broader and rounder than the first pair, and the margins begin to show signs of the pointed teeth which characterize the later leaves. Sometimes a few weak hairs are present. Three stages in the development of the seedling are shown in Fig. 3. Up to a certain stage the seedlings and young plants of dandelion are difficult to distinguish from those of hawkweed (*Crepis capillaris*). This weed is to be described in a future article in which the differences between the two plants will be pointed out.

Distribution.—Dandelion is widely distributed in both Islands of New Zealand, though it is not found in nearly so great a variety of soils and situations as catsear. It is particularly common on roadsides and such waste places, and is also abundant amongst grass, even when the latter is tall enough to cover the leaves over. In pastures that have been heavily stocked, however, dandelion,

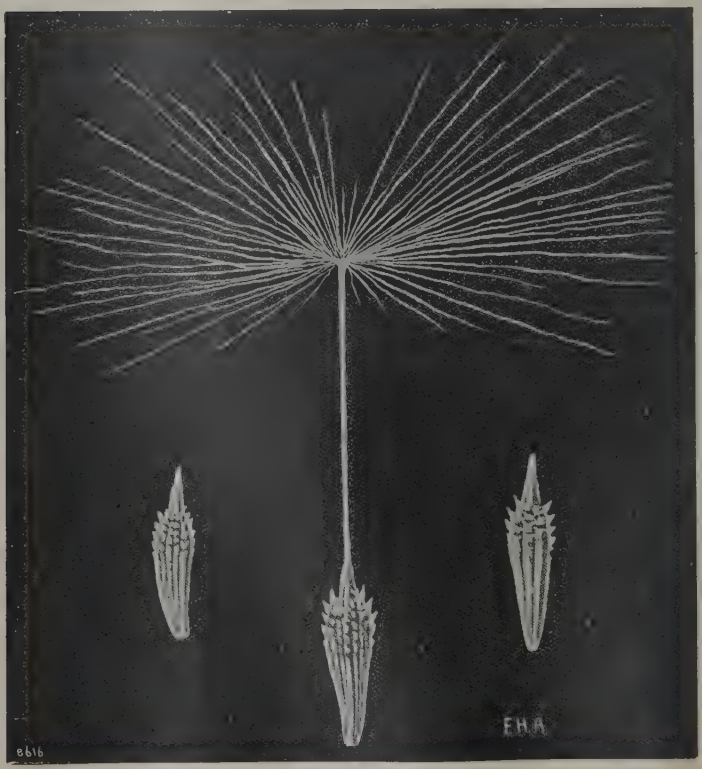


FIG. 4. ACHENES OF DANDELION, ONE BEARING A PAPPUS. MAGNIFIED 6 TIMES.

unlike catsear, does not persist to any great extent. It is also a weed of lawns, but here again cannot be ranked with catsear in importance.

The achenes of dandelion are occasionally found as impurities in some agricultural seeds.

PRACTICAL TOMATO-GROWING.

MISS M. BRASELL.

THE following notes on outdoor tomato-culture, written in response to requests from officers of the Department of Agriculture and others, may, it is hoped, be of some interest and benefit to young growers. The practice described is based on experience gained in commercial tomato-growing at the Lower Hutt extending over a number of years, during which time many manurial and other tests have been carried out.

Propagation.—In growing tomatoes the first and most important thing is to have good strong and hardy plants. For the raising of such plants a mixture of soil and manure is prepared: this is put into boxes made from apple-cases cut in halves lengthwise. Care should be taken not to sow the seed too thickly, otherwise the seedlings will be weak and spindly. The box is then placed on a hotbed or in a heated glasshouse. When the plants break into rough leaf they are picked out into boxes at about 3 in. apart and returned to the hotbed or house. When rooted they are removed to a cold frame, where they are hardened off by gradually submitting them to the same weather-conditions as they will have in the field. This is done by leaving the top-lights of the frame off during fine weather. Should rough weather set in, the lights must not be removed.

Site, Soil, and Tilth.—My remarks under this head refer only to our own place, which has a northerly aspect, lies near the hills, and is surrounded by good shelter-belts. The land is well drained, and the soil, which is of a stiff loam nature, has been used for fifteen years for tomato-growing. We plough our land in the autumn, after which it receives a dressing of 1 ton of lime per acre, and is then left to aerate throughout the winter. In spring, before planting out, the soil is well worked and broken down to a fine tilth.

Planting and Manuring.—This work is usually undertaken in November. Prior to planting, the rows are marked out at about 3 ft. apart; lines are drawn and opened out in drills. The ground being ready, the plants are cut out of the boxes and planted about 18 in. apart. It is usual to apply a dressing of artificial (garden) manure when planting, followed by a similar application

when the first fruit-trusses have set, and again after an interval of about six weeks, with a final dressing of nitrate of soda, &c., late in the season to assist the top fruits.

Training.—The plants are trained on the two-stem system, supported by wire trellis. Almost as soon as the young plants have taken fresh root, side-shoots begin to appear: these must be kept under observation and frequently rubbed off, retaining the two main growths. The bed by this time will need scarifying and the soil around the plants hoeing. The next thing to be done is to erect the trellis-posts and strain up the first wire on which to bear the plant. It is wise to have this done as soon as possible, as it steadies the plants and lessens the damage by wind. The second and third wires are added as the plants require to be trained and tied. The wires are usually about 1 ft. apart. By the time the plants reach the third wire the bottom trusses of fruit should be beginning to ripen. It is necessary to keep the soil well worked and free from weeds throughout. When the plants become too large to allow of a horse cultivator being employed with safety a Planet Junior or Dutch hoe should be used for this purpose.

Spraying.—From the time the plants are small seedlings until the season is well advanced they should be sprayed regularly every two or three weeks with Bordeaux mixture. To miss one spraying often results in a big loss of fruit. The strength of spray used when the plants are young is 3-5-50 (sulphate of copper, lime, and water respectively). The strength is increased as the plants mature, finishing with 4-5-50.

Packing and Grading.—The writer's experience is that the benefit of careful grading and packing applies equally to tomatoes as to other fruits. The results will amply repay the grower for the little extra care required in putting the produce before the public in a uniform and attractive manner. Our fruit is picked and taken to the packing-house and placed on the bench, where it is sorted into three grades—ripe, half-ripe, and second quality. All specked and diseased fruit is discarded and destroyed. Extra handling is saved by having three boxes in front of the packer and grader when sorting. Tomatoes pack and carry better when not too ripe.

The 1914 annual report of the Medical Officer of Health for the City of London, in dealing with meat or meat-products condemned from all causes, makes no mention whatever of New Zealand meat. On the other hand, it is recorded that forty-five quarters of beef from South America were found to be affected with tuberculosis when taken to Smithfield Market.

CERTIFICATE-OF-RECORD DAIRY COWS.

W. M. SINGLETON.

HEREWITH are illustrations of two cows which have recently produced records of butter-fat under semi-official test that place them at the top of their respective classes, and also distinguish them as New Zealand's record cows of their breed.

The Friesian cow is Manor Beets Daughter II of Ashlynn, bred, owned, and developed by Mr. C. A. Hopping, of Ashlynn Park,

MANOR BEETS DAUGHTER II OF ASHLYNN.

Highest-record Friesian and champion butter-fat cow of New Zealand.

Rangitikei Line, Palmerston North. Reference was made in the September *Journal* to this cow's splendid record of 18,733·9 lb. milk, containing 863·51 lb. fat, produced in 365 days.

The Ayrshire cow, Alexandra of Waipapa, is a good illustration of the old adage, "Good goods in small parcels." Her record of 14,348·6 lb. milk, containing 591·16 lb. fat, produced in 365 days, places her, as indicated, not only at the head of the four-year-old

class, but as the highest-record Ayrshire to date. With this production she displaces as leader of the four-year-olds Posy of Cambridge, owned by Messrs. Watt Bros., while, as holding the highest record for her breed, she also displaces Minnie of Glenweir, owned by Messrs. Weir Bros., of Pukehiki, Dunedin.

ALEXANDRA OF WAIPAPA.

Highest-record Ayrshire.

Alexandra of Waipapa was bred by Mr. J. U. G. Slack, and was developed and is owned by Mr. F. Mills, Hawera, president of the Ayrshire Cattle-breeders' Association. Mr. Mills's success with this and other cows which he has placed on test sets a high standard for future presidents.

According to the 1914 annual report of the Medical Officer of Health for the City of London, 10 per cent. of the samples of milk taken were found to contain living tubercle bacilli. During the year only forty-nine such samples were examined. This is interesting compared with the fact that in connection with the Christchurch (New Zealand) milk-supply alone the Department of Agriculture examined fifty samples during the year ended 31st March, 1914, none of which were found to contain tubercle bacilli.

BOX TESTS OF TYPICAL SOILS.

G. DE S. BAYLIS.

WITH a view to further demonstrating the box-test method described in the August issue of the *Journal*, typical samples of top soils were obtained from certain areas in the following districts: Bell Block, Putaruru, Foxton, Waihi, Eketahuna, Opaki, Rapanui, Te Awamutu, Hawera, Taumarunui. These are mostly light to medium soils some of which are of considerable fertility, while others are not too well supplied with plant-food.

Oats was the crop selected, and the boxes were broadcast-sown on the 17th May last, the location of the test being Palmerston North. All the boxes used were the small size, measuring 9 in. by 12 in. by 6 in. As it was desirable to limit the number of boxes, a complete test was not attempted, the sole object being to illustrate the action of different fertilizers. Naturally the winter season precluded rapid growth.

The fertilizers applied were as follows:—

Series 1 boxes—no manure.

Series 2 boxes—3 parts superphosphate.

Series 3 boxes—3 parts basic slag.

Series 4 boxes—3 parts complete mixture, consisting of 1 part superphosphate, 1 part bonemeal, 1⅓ part dried blood, ½ part sulphate of potash, ¼ part sulphate of ammonia.

Series 5 boxes—18 parts chopped green clover dug under, and 3 parts basic slag.

The following tabulation shows the average height and general condition of the oats in the respective series of boxes on the 11th August:—

Series 1 Boxes.	Series 2 Boxes.	Series 3 Boxes.	Series 4 Boxes.	Series 5 Boxes.
Te Awamutu Soil (a).				
10 in. Pale; no stool.	9 in. Pale, thin stalks; no stools.	11–12 in. Better than foregoing; pale.	14–15 in. Good colour; thick growth.	14 in. Fainter colour than No. 4, but good.
Taumarunui Soil.				
6 in. Pale, sickly, discoloured.	6 in. Very Sickly, discoloured.	7–8 in. Better, but sickly and discoloured.	13–15 in. Broad, healthy leaves, not discoloured.	13–15 in. Much as No. 4.
Putaruru Soil.				
8 in. Pale, thin, sickly.	9–10 in. Better, but no stools.	9 in. Hardly as good as No. 2.	14–15 in. Heavy stool; broad green leaves.	15–16 in. Heavy and dense.

Series 1 Boxes.	Series 2 Boxes.	Series 3 Boxes.	Series 4 Boxes.	Series 5 Boxes.
Eketahuna Soil.				
10–11 in. No stool; sickly, discoloured.	12–13 in. Stronger; fair colour; thicker stems.	12–13 in. Not quite so good as No. 4.	14–15 in. Thick stalks, heavy leaves; good colour.	14–15 in. Much as No. 4; good stools.
Waihi Soil.				
5 in. Pale and sick; thin stems.	7 in. Better colour.	7 in. Much as No. 2.	14–15 in. Fair stools; rich colour.	13–14 in. Good; much as No. 4.

Considering that all the boxes were sown on the same date it is interesting to note the difference in growth made, not only in boxes filled with the same soil and to which different fertilizers had been applied, but also on the different soils. While under identical conditions, it took the soil procured from Waihi eighty-six days at that season of the year to grow oats 5 in. high, the soil from Eketahuna under similar conditions grew oats 10 in. to 11 in. high. During eighty-six days' growth Waihi soil without manure could only grow oats 5 in. high, but with a complete fertilizer a height of 14 in. to 15 in. was obtained; and so on with the other soils and fertilizers. While the range of difference in the super series amounted to 6 in., the range of difference in the complete-manure series is only 2 in.

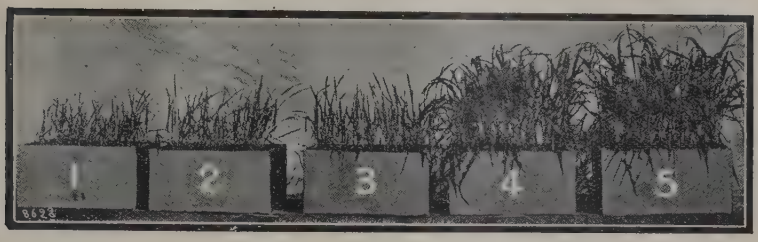
Comparing the same soil with the different fertilizers applied to it, we get, in the case of Waihi, a range of difference from 5 in. with no manure to 15 in. with complete manure. The smallest range is from 11 in. to 15 in. in the Eketahuna soil.

Up to the stage of growth recorded the fertilizer most generally beneficial to these soils for the oat has been the complete mixture. It is, however, run very close by green manure and slag. The use of super has generally so far on the soils under this test been less beneficial than slag.

Comparing the slag series with slag and green manure, there is a strong argument in favour of the ploughing-under of green crops, or the residue of green crops, upon these soils. Foxton made 8 in. more growth during the same number of weeks when green manure was applied. Similarly, Waihi made 7 in., Putaruru 7 in., Taumarunui 7 in., Te Awamutu 2 in., and Eketahuna 2 in. more.

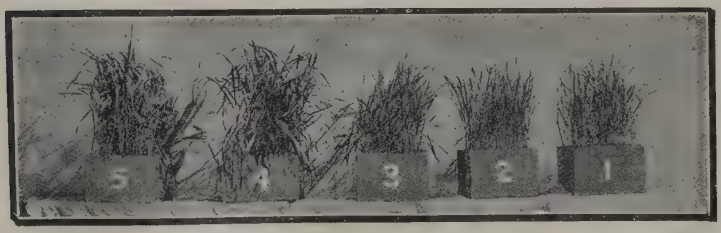
The two chief points brought out up to this stage of growth suggest the advisability of using a complete fertilizer for the oat upon these soils in preference to any single ingredient; also that green manure with phosphoric acid added in the shape of slag may to a certain extent be made to take the place of some of the

SOME OF THE BOX TESTS.



WAIHI SOIL; RECORDED 11TH AUGUST.

TE AWAMUTU SOIL (B); RECORDED 20TH AUGUST.



RAPANUI SOIL; RECORDED 20TH AUGUST.

FOXTON SOIL; RECORDED 20TH AUGUST.

Series 1—No manure. Series 2—Superphosphate. Series 3—Basic slag. Series 4—Completé mixture. Series 5—Green manure and basic slag.

more expensive fertilizers used in the complete mixture. The effect of potash in conjunction with slag and green manure on these soils remains yet to be demonstrated. In the meantime the superiority of the treatment given by green manure and slag over slag alone speaks for itself in every instance.

The tabulation as under shows the average height, green weight, and general condition of the oats in the respective series of boxes on the 20th August:—

Series 1 Boxes.	Series 2 Boxes.	Series 3 Boxes.	Series 4 Boxes.	Series 5 Boxes.
Te Awamutu Soil (b).				
11–12 in. 0·93 oz. Pale, thin.	12–14 in. 1·34 oz. Pale; no stools.	11–13 in. 1·09 oz. Sickly.	17–18 in. 3·65 oz. Colour fair; strong growth.	18–19 in. 3·97 oz. Better and stronger.
Bell Block Soil.				
12–13 in. 1·31 oz. Pale, thin; no stools.	12–13 in. 1·28 oz. Pale, thin; no stools.	11–12 in. 1·09 oz. Pale, thin; no stools.	16–18 in. 3·40 oz. Dense; good stools; fair colour.	18 in. 3·78 oz. Dense; good colour; stools.
Opaki Soil.				
9–11 in. 0·90 oz. Pale, thin; no stools.	9–10 in. 0·90 oz. Pale, thin; no stools.	10–11 in. 0·97 oz. Pale, thin; no stools.	15–17 in. 3·62 oz. Growth dense; colour fair.	13½–16 in. 3·15 oz. Growth dense; colour fair.
Rapanui Soil.				
11–13 in. 1·68 oz. Fair colour.	11–13 in. 1·78 oz. Fair colour.	13 in. 2·87 oz. Better than No. 2; stalks stout.	16–18 in. 4·34 oz. Colour good; growth dense; good stools.	16–18 in. 3·78 oz. Colour good; growth dense; good stools.
Foxton Soil.				
6–7 in. 0·53 oz. Leaves much discoloured.	6–7 in. 0·53 oz. Rather better colour.	7 in. 0·59 oz. Rather better colour.	15 in. 3·06 oz. Colour rich; leaves broad; stooling.	13–14 in. 2·5 oz. Not quite equal to No. 4.

All the above soils are of a light nature. It will be noticed that at this stage of growth and season of the year (20th August) the height-measurements in the super series show in many cases little variation from the no-manure series. The weights, however, in the case of Te Awamutu and Rapanui show decided differences.

Of course these trials would need to be repeated more than once, and with varying quantities of fertilizers, before any definite statements could be made. Nevertheless they serve to suggest some matters worthy of consideration.

Used alone slag appears to have been more useful than super under the conditions appertaining to the Opaki and to the Rapanui and Foxton soils. In the cases where slag has been inferior to super it will be noticed that when applied in conjunction with green manure a considerable increase is obtained over the complete

fertilizer. The action of the slag is known, among other things, to be largely influenced by the content of organic matter in the soil.

The Bell Block sample decidedly wants organic matter before best results are likely to be obtained by the use of artificial fertilizers, although a complete manure in the case of oats is decidedly preferable to the application of phosphoric acid alone. The latter has given no results up to the present stage of growth, the stimulating action of the one ingredient having produced an unhealthy appearance in the plants owing to their inability to procure the other forms of plant-food necessary.

The application of the complete fertilizer has been in every case markedly beneficial, and such results constitute a strong argument in favour of the use of such a fertilizer on all light soils likely to be deficient in a general supply of plant-food.

On the Rapanui soil the marked results of slag are noticeable under conditions prevalent, but an enormous increase is gained by the use of the complete fertilizer, which increase is not maintained to the same extent when green manure and slag are substituted. One of the reasons may be that the green manure had not been long enough in the ground to become available in sufficient quantities for the plant's use, and the fact that potash was included in the complete-mixture series, and was not included in the green-manure and slag series.

In studying the slag and green-manure series comparison must be made with the slag-only series. In all cases slag and green manure have given an enormous increase as compared with slag alone. In the Te Awamutu and Bell Block samples, slag and green manure have given even better results than the complete mixture. On the Opaki, Rapanui, and Foxton samples, slag, although giving a large increase when used in conjunction with green manure as compared with its action when used alone, is not so beneficial as the complete mixture. In field experiments this Opaki soil has responded to the application of potash. The Foxton sample is probably deficient in the same ingredient.

In regard to the soils recorded on the 20th August, the indications are that the ploughing-under of green crops, or the residues of green crops, will be decidedly beneficial to all these soils. If such is done, Te Awamutu and Bell Block samples, with the addition of slag, should grow good oats. In the case of Opaki and Foxton the use of a complete fertilizer, in addition to the green manure, would be beneficial for the oats, until further inquiry has shown if it will be necessary to use blood-and-bone meal, if potash as well as slag is applied after green-manuring.

SOUTH ISLAND LIMESTONE ANALYSES.

B. C. ASTON, F.I.C.

THE samples of South Island limestones officially analysed are here tabulated with the results of the analyses.

It will be observed that no samples have been analysed from the following counties: Sounds, Murchison, Waimairi, Tawera, Malvern, Paparua, Halswell, Heathcote, Springs, Ellesmere, Akaroa, Wairewa, Mount Herbert, Levels, Waihemo, Waikouaiti, Peninsula, Taieri, Clutha, Tuapeka, Fiord. Samples from these counties will be welcome, and will be reported on free of charge. A sharp lookout should be kept for soft limestone or chalk deposits which are known to occur in many localities in the South Island. This form of carbonate of lime may be applied to the land without previous treatment, hence obviating the expense of grinding.

The analyses of the North Island samples were given in the *Journal* for September.

ANALYSES OF LIMESTONES: SOUTH ISLAND.

(Compiled from Official Reports.)

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
	Marlborough County.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
4550	Seven miles from Blenheim	2·41	4·22	90·67	2·16	0·54	79	1887	Vesicular limestone.
8136	Wairau Valley ..	9·63	1·84	83·64	2·69	1·86	..	1898	H_2S, 0·34 per cent. Massive limestone.
1979–1	Cement Company, Marlborough	..	..	30·34	..	..	..	1909	
2017–1	Picton District ..	40·90	16·10	33·02	2·10	5·30	..	1909	
2	,, ..	44·30	18·80	27·70	3·30	5·60	..	1909	
2119–1	Taylor's Pass, Blenheim	..	..	90·90	..	..	80	1910	
2	Ditto	..	..	91·40	..	..	80	1910	
C 935	Near Blenheim ..	7·85	0·02	91·35	..	..	80	1913	
B 401	Flaxbourne ..	24·95	2·05	68·80	0·80	1·78	..	1911	
	Kaikoura County.								
D 1220–1	Kaikoura	..	..	58·07	..	..	..	1914	
2	,, ...	12·68	1·16	84·00	0·14	1·85	77	1914	
3	,, ...	..	..	29 55	..	..	..	1914	
4	,, ...	..	..	41·70	..	..	..	1914	
5	,, ...	..	..	47·20	..	..	..	1914	

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
	Collingwood County.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
1417	Collingwood ..	1·03	1·31	53·51	42·61	0·51	..	1876	Dolomite.
3075–1	Ruataniwha, Collingwood	47·60	1·92	48·61	1·63	0·24	..	1882	Calcareous sandstone.
2	Ditto	2·40	4·58	90·12	2·79	0·11	80	1882	Marble.
3	,, ...	5·60	2·21	88·96	2·94	0·29	..	1882	,,
3378	Ferntown	9·92	0·89	86·71	2·31	0·17	..	1883	
481	Pakawau, Golden Bay	0·5	0·40	99·10	..	..	98	1907	
1216	Castle's, Parapara ..	6·40	3·00	87·00	0·32	3·28	..	1907	
1220	,, ,, ..	18·30	7·85	70·40	0·30	3·15	..	1907	
1221	Fifteen-mile Creek, Aorere River	31·10	14·80	49·50	0·20	4·40	..	1907	
1517–1	West Wanganui district (Sandhill Creek)	12·45	2·52	82·86	2·12	0·05	..	1907	
2	Ditto	10·12	2·30	84·26	2·83	0·49	..	1907	
3	,, ...	9·42	2·25	85·00	2·50	0·83	..	1907	
4	,, ...	11·10	2·32	84·57	1·50	0·51	..	1907	
5	,, ...	14·72	2·37	81·96	0·84	0·11	..	1907	
6	,, ...	19·38	3·57	76·18	0·84	0·03	..	1907	
C 971	Bainham	20·10	1·10	78·18	..	..	..	1913	Hard to crush. Poor limestone.
	Takaka County.								
2664	Motupipi Coal-mine	1·89	0·74	74·93	7·92	14·52	..	1880	Carbonaceous limestone.
6222–1	Motupipi	28·23	0·81	67·88	2·96	0·12	..	1893	Fairly hard stone.
2	,, ...	27·86	0·72	68·01	3·20	0·21	..	1893	,,
6260	,, ...	7·43	0·93	89·44	1·99	0·21	..	1893	Hard coherent stone.
1102–2	,, (French's River)	9·80	3·85	82·20	0·40	3·75	..	1908	
3	Between Pohara and Limestone Bay	2·50	2·10	89·90	1·65	4·75	..	1908	
4	Ditto	23·50	6·65	65·35	0·30	4·20	..	1908	
9	,, ...	8·40	1·25	84·05	1·02	5·28	..	1908	
1239–1	Motupipi	5·90	3·20	89·60	1·20	0·10	..	1908	
2	,, ...	11·60	5·50	81·00	1·60	0·3	..	1908	
3	,, ...	10·10	3·90	84·60	1·20	0·20	..	1908	
4	,, ...	19·40	3·00	76.40	1·00	0·20	..	1908	
5	,, ...	6·00	3·10	90·00	0·80	0·10	..	1908	
1414	Terakohe, Takaka ..	6·50	1·80	86·40	1·80	3·50	..	1908	
2126–3	Golden Bay ..	40·42	20·02	26·62	5·70	5·80	..	1909	
	Waimea County.								
6641	Croixelles, Onitea Bay	3·14	1·42	91·73	3·47	0·24	..	1895	Very solid prime limestone.
8716	Vicinity of Nelson ..	8·18	0·46	88·20	2·95	0·21	..	1900	Coherent white stone.
853–1	Baton River district	1·20	0·70	98·10	..	..	..	1907	
2	,,	..	..	54·00	..	..	..	1907	
H 182	Nelson	1·03	1·77	97·20	..	..	96	1907	
183	,, ...	1·48	0·77	95·70	..	..	94	1907	
184	,, ...	4·60	3·77	91·63	..	..	88	1907	
654	Belgrove	0·59	0·45	95·86	0·10	..	96	1907	
655	,, ...	3·50	0·69	94·56	..	..	91	1907	
J 84	Nelson	6·93	2·24	89·60	1·18	..	84	1908	
228	Wangapeka ..	1·60	2·56	95·67	..	..	93	1909	
229	,, ..	0·56	0·07	99·37	..	..	99	1909	
230	,, ..	6·04	1·32	85·36	..	..	68	1909	
231	,, ...	26·22	4·76	68·92	..	..	55	1909	
2228–1	Quail Valley, Belgrove	6·85	2·15	86·00	0·80	..	..	1909	
2	,, ,,	3·41	3·00	90·14	0·40	..	..	1909	
C 316	Riwaka	3·34	1·59	94·12	..	..	93	1913	
	Buller County.								
5343–1	Cape Foulwind ..	3·61	1·81	91·30	2·94	0·34	..	1890	Concretionary limestones.
2	,, ..	3·47	1·64	90·62	2·86	1·41	..	1890	Ditto.
6154	,, ..	2·03	1·26	93·18	3·12	0·41	..	1892	Rathe soft limestone.
8460	,, ..	0·64	1·47	95·22	2·46	0·21	..	1899	
K 143	Buller County ..	1·16	1·56	94·99	1·65	..	93	1909	
B 315	Cape Foulwind ..	2·15	1·08	94·82	1·06	0·89	92	1912	
	Inangahua County.								
C 673–1	Cronadun	13·20	1·92	81·14	0·24	2·87	73	1913	
2	,, ...	7·55	2·12	87·50	0·85	2·28	80	1913	
3	,, ...	2·05	1·09	95·45	0·48	1·43	92	1913	

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
	Grey County.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
2756–4	Greymouth ..	9.04	0·81	88·12	1·71	0·32	..	1880	
5	,, ..	17·45	1·81	78·51	1·86	0·37	..	1880	
1	,, ..	20·44	1·41	75·67	2·20	0·28	..	1880	
3	,, ..	20·21	1·83	75·91	1·82	0·23	..	1880	
2	,, ..	23·09	4·93	68·12	3·54	0·32	..	1880	
6	,, ..	28·06	1·98	64·74	2·21	1·01	..	1880	
K 2953	Blackball	6·46	1·60	91·07	..	..	87	1909	
A 847	Cobden, Greymouth	18·45	1·75	74·64	1·22	2·46	..	1911	
A 848–1	Kotuku	..	..	62·50	..	..	..	1911	
2	,, ...	..	..	72·78	..	..	..	1911	
A 1148	Greymouth ..	10·96	5·64	80·32	2·50	0·41	..	1911	
C 866	Totara Flat ..	6·36	1·59	90·00	0·82	0·29	84	1913	
	Westland County.								
8873–1	Koiterangi ..	18·62	..	81·04	..	0·34	..	1900	Approximate analysis.
2	,, ..	19·64	..	79·90	..	0·46	..	1900	,,
3	,, ..	15·02	..	84·47	..	0·51	..	1900	,,
1070–1	Koiterangi (Mount Camelback)	..	..	94·88	..	..	..	1908	..
2	Ditto	..	..	87·38	..	..	..	1908	
3	,, ...	..	..	84·54	..	..	..	1908	
4	,, ...	..	..	83·75	..	..	..	1908	
1442–1	Koiterangi Hill ..	6·35	1·70	88·31	2·38	1·26	..	1908	
2	Hudson Creek, Ross	5·45	1·17	90·39	1·62	1·37	..	1908	
H 1177	Koiterangi ..	25·47	3·86	63·99	2·64	..	52	1907	
1178	,, ..	14·91	6·66	74·84	1·97	..	62	1907	
1179	,, ..	9·92	1·06	82·34	1·37	..	76	1907	
J 134	,, ..	29·91	1·81	67·34	..	..	54	1908	
135	,, ..	37·55	6·05	52·48	..	..	40	1908	
401	,, ..	25·56	2·20	70·43	0·50	..	58	1908	
402	,, ..	19·06	1·86	78·36	0·02	..	69	1908	
K 507	Hokitika	16·66	3·88	77·40	1·35	..	64	1909	
A 438	Bray Creek ..	2·02	1·06	93·12	2·00	0·80	..	1911	
440	Point Elizabeth ..	14·05	2·80	79·61	1·30	0·64	..	1911	
441	Rapahoe Ranges ..	16·50	1·92	77·19	1·21	1·81	..	1911	
D 600–1	Hokitika	11·20	3·95	81·20	3·65	..	75	1914	Hardly pure enough for burning.
2	,, ...	33·40	5·05	58·26	3·29	..	45	1914	Poor limestone.
	Amuri County.								
1927	Amuri Bluff ..	6·41	6·59	84·84	2·16	..	..	1874	Very hard stone.
4274	,, ..	19·96	10·44	66·36	3·24	..	..	1886	Brown "cone-in-cone" limestone.
	Cheviot County.								
6376	Cheviot Estate ..	4·16	0·43	90·65	3·64	1·12	..	1893	Loose-grained, granular.
8127	Cheviot	53·76	2·48	38·34	1·24	4·18	..	1898	Soft stone.
1860	,, ...	40·60	15·38	32·57	19·20	1·88	..	19·09	
D 1107–1	,, ...	21·48	1·88	74·11	2·53	..	62	1914	Inferior stone.
2	,, ...	21·37	3·49	70·17	4·97	..	57	1914	,,
G 218	,, ...	..	..	88·92	..	..	..	..	
219	Port Robinson ..	..	..	72·92	..	..	..	..	
220	,, ..	..	..	60·68	..	..	..	..	
221	,, ..	..	..	26·67	..	..	..	..	Very soft stone.
222	Domett	..	..	80·80	..	..	..	..	
	Waipara County.								
F 340	Scargill	25·89	0·21	53·10	2·07	18·73	50	1905	Very porous and friable.
G 433	Waikari	..	..	64·10	..	..	52	1906	
434	,, ...	..	..	50·46	..	..	36	1906	
G 208	Te Paka, Scargill ..	..	..	91·79	..	..	..	1915	
209	,, ,, ..	..	..	80·08	..	..	..	1915	
210	Weka Pass Road, Waikari	..	..	72·92	..	..	..	1915	
211	Weka Pass, Waikari	..	..	75·61	..	..	..	1915	
212	Wandle River ..	..	..	6·19	..	..	..	1915	Papa.
213	Hurunui	..	..	70·91	..	..	..	1915	
214	Waikari	..	..	71·31	..	..	..	1915	Soft limestone.
215	,, ...	..	..	77·39	..	..	..	1915	
216	,, ...	..	..	65·47	..	..	..	1915	Soft limestone.
217	Weka Pass, Waikari	..	..	92·65	..	..	..	1915	
223	Braemyle, Waikari ..	..	..	59·39	..	..	..	1915	
224	,, ,, ..	..	..	79·40	..	..	..	1915	

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
	Waipara County—ctd.								
225	Waikari	..	..	79·26	..	..	..	1915	
226	,, ...	..	..	60·82	..	..	..	1915	
397	,, ...	..	..	69·5	..	..	..	1915	Soft limestone.
398	,, ...	..	..	43·3	..	..	..	1915	,,
399	,, ...	..	..	69·7	..	..	..	1915	,,
400	,, ...	..	..	59·0	..	..	..	1915	,,
401	,, ...	..	..	3·5	..	..	..	1915	Marl.
402	,, ...	..	..	93·9	..	..	..	1915	Soft limestone.
	Ashley and adjoining Counties.								
2819	Oxford	32·10	0·92	66·82	..	0·16	..	1881	Chalk.
2597	,, ...	15·69	1·84	82·26	..	0·21	..	1881	,,
937	Mount Grey, Rangiora	1·90	4·50	88·15	1·91	2·98	..	1907	
G 204	View Hill	..	..	67·80	..	..	..	1915	
205	,, ...	..	..	84·05	..	..	..	1915	
206	Whiterock ..	..	..	78·65	..	..	..	1915	
207	,, ...	..	..	96·08	..	..	..	1915	
	Selwyn County.								
4032	Malvern Hills ..	0·21	0·58	96·42	2·79	..	..	1885	Excellent stone.
5328–1	Selwyn district ..	..	..	62·13	..	..	..	1890	
2	,, ..	..	..	54·17	..	..	..	1890	
3	,, ..	..	..	41·99	..	..	..	1890	
4	,, ..	..	..	79·95	..	..	..	1890	
8	,, ..	..	..	95·21	..	..	..	1890	
	Ashburton County.								
3685	Ashburton ..	1·29	0·21	95·75	2·64	0·11	..	1884	Crystalline limestone.
5964–1	Mount Somers ..	14·01	3·14	79·79	2·86	0·20	..	1892	Fairly friable.
2	,, ..	9·87	6·22	80·78	2·89	0·24	..	1892	,,
3	,, ..	2·25	1·39	93·24	2·96	0·16	..	1892	
G 171	Cavendish ..	..	..	98·27	..	..	..	1915	
172	Mount Somers ..	..	..	94·76	..	..	..	1915	
173	Staveley	..	..	88·35	..	..	..	1915	
	Geraldine County.								
4122–1	Kakahu	1·31	0·34	95·18	2·96	0·21	..	1886	Subcrystalline stone.
2	,, ...	2·17	0·61	93·49	3·49	0·24	..	1886	,,
4118	,, ...	19·64	0·76	76·91	2·69	..	..	1886	
G 167	,, ...	..	..	79·48	..	..	..	1915	
168	,, ...	..	..	7·03	..	..	..	1915	Marl.
169	Upper Te Moana ..	..	..	69·90	..	..	..	1915	
170	Upper Waitohi ..	..	..	72·78	..	..	..	1915	
	Mackenzie County.								
6480–1	Albury	18·20	3·63	74·92	3·04	0·21	..	1893	Fairly good freestone.
2	,, ...	17·63	3·02	76·00	3·17	0·18	..	1893	,,
3	,, ...	14·49	4·12	77·05	4·03	0·31	..	1893	,,
6810	,, ...	40·81	0·41	56·48	2·06	0·24	..	1895	Sandy limestone.
8681–1	,, ...	12·26	1·41	82·21	2·94	0·82	..	1900	$CaSO_4$, 0·13 per cent. Fairly compact.
2	,, ...	11·36	1·64	82·72	2·86	1·01	..	1900	$CaSO_4$, 0·11 per cent. Fairly compact.
3	,, ...	11·49	1·71	83·02	2·64	0·64	..	1900	$CaSO_4$, 0·10 per cent. Fairly compact.
G 166	Fairlie	..	..	69·20	..	..	..	1915	
	Waimate County.								
6204–1	Waihao Downs ..	25·42	1·82	69·69	2·43	0·64	..	1893	Limestone with siliceous bands.
2	,, ..	6·01	1·64	89·04	2·98	0·33	..	1893	Limestone without siliceous bands.
2026–1	Upper Waitangi, Waimate	88·11	8·61	1·84	0·80	0·02	..	1909	
2	Awahei Creek, Waimate	22·10	5·25	66·99	1·70	2·21	..	1909	
3	Waikuku Creek, Waimate	18·53	4·18	71·33	1·76	2·24	..	1909	
4	Waitangi River, Waimate	49·67	10·87	31·40	2·62	5·66	..	1909	
G 159	McCulloch's Bridge, Waihao	..	..	29·10	..	..	..	1915	
160	Waihao Downs ..	..	..	90·25	..	..	..	1915	
161	,, ..	..	..	64·58	..	..	..	1915	

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
	Levels County.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
G 162	Upper Pareora River	..	..	87·22	..	..	..	1915	
163	Cave	..	..	65·64	..	..	..	1915	
164	,, ...	..	..	83·66	..	..	..	1915	
165	Sutherland's ..	..	..	23·56	..	..	..	1915	
	Waitaki County.								
3789	Waireka Valley, Oamaru	18·24	8·37	67·08	2·63	3·68	..	1884	Rather friable.
1426–1	Oamaru	2·03	2·61	93·63	3·60	..	..	1907	Building-stone.
2	,, ...	3·05	3·78	93·02	3·24	..	..	1907	,,
3	,, ...	0·97	1·53	95·57	3·50	..	..	1907	,,
A 330	Totara district Oamaru	..	..	92·84	..	..	..	1911	
D 1022	Oamaru	1·15	2·03	96·06	0·76	..	93	1914	High-grade stone.
	Bruce County.								
9402	Milburn	10·10	1·75	86·35	1·05	0·75	..	1902	Contains particles of chlorite. Fairly hard.
	Maniototo County.								
3387	Maniototo.. ..	0·91	0·16	95·94	2·88	0·11	..	1883	Marble.
	Vincent County.								
3453	Manuherikia (Alexandra)	32·39	1·60	60·74	2·08	3·19	..	1883	Sandstone.
	Lake County.								
3438	Whakatipu ..	0·21	0·90	96·81	2·06	0·02	..	1883	Marble.
E 166	Gibbston	..	..	95·19	..	..	..	1904	
J 323	Lake Hayes ..	7·95	0·80	84·32	..	..	84	1908	
324	,, ..	8·17	2·50	80·17	0·39	..	78	1908	
1570–1	,, ..	7·15	5·24	83·86	0·40	1·77	..	1909	
2	,, ..	41·90	26·18	18·91	5·14	3·72	..	1909	
3	,, ..	10·78	7·52	79·16	0·80	1·03	..	1909	
4	,, ..	6·30	4·37	86·02	0·50	1·57	..	1909	
5	,, ..	10·54	6·40	79·15	0·60	1·61	..	1909	
E 987	Frankton (near) ..	36·85	7·80	46·57	1·80	5·85	..	1911	
	Southland County.								
3830	The Dome ..	1·98·	0·51	94·71	2·69	0·11	..	1885	Excellent limestone.
7401–1	Hokonui (Forest Hill)	5·19	2·94	88·88	2·78	0·21	..	1897	Coherent.
2	,, ,,	6·03	2·76	88·00	2·04	0·17	..	1897	,,
3	,, ,,	0·31	0·22	96·69	3·69	0·09	..	1897	Crystalline (part of a thin vein).
4	,, ,,	5·92	0·24	90·29	3·39	0·16	..	1897	Coherent.
8551	Hedgehope ..	4·19	4·35	87·26	3·47	0·73	..	1899	Shelly limestone.
G 206	Grove Bush ..	7·16	1·70	88·64	0·33	..	84	1906	
207	,, ..	4·25	2·31	90·48	0·45	..	88	1906	
366	Forest Hill ..	2·52	1·37	93·75	..	..	..	1906	Ground limestone, sold in Southland.
367	,, ..	7·44	2·25	88·50	..	..	..	1906	Ditto.
507	Brown's	..	..	99·09	0·67	..	98	1906	
508	,, ...	3·65	..	93·40	1·35	..	90	1906	
509	,, ...	11·76	4·02	80·25	1·37	..	72	1906	
B 1080	Balfour	..	..	77·84	..	..	..	1912	
	Wallace County.								
D 1034	Fairfax	5·69	1·94	91·56	0·81	..	86	1914	Good limestone.

NOTE.—An article by Mr. A. McTaggart dealing with recent developments in connection with limestone deposits in Canterbury will be published in the November issue of the *Journal*.—ED.

Attention is drawn to the announcement in the advertising section of this issue giving particulars of the annual sale of Weraroa milk-record Holstein and Shorthorn bulls, &c., which takes place at the Farm on the 2nd November.

TOMATO MANURIAL TESTS.

FURTHER tests of artificial manures on tomatoes were conducted last season by Mr. J. Brasell at the Lower Hutt, Wellington, in co-operation with the Horticulture Division of the Department, on the lines of previous trials recorded in the *Journal* for July and October, 1913. A summary of the tests is furnished in the following report by Mr. T. C. Webb, jun., Orchard Instructor, who had charge of the arrangements :—

NO. 1 PLOT.

After the ground was thoroughly worked up the drills were opened with a banker, the manure applied, and then worked over with the scarifier, after this the plants were set out in the drills. Six rows were planted on 4th November, 1914, plants 18 in. apart, averaging 150 to the row. The manures consisted of 20 lb. mixed bonedust, 30 lb. superphosphate, 10 lb. sulphate of potash, and 10 lb. kainit. This averaged 12 lb. of mixture per row with one dressing only.

The crop gave an average yield of 816 lb. per row, and 5½ lb. per plant, the total weight of the crop being 4,896 lb.

NO. 2 PLOT.

This plot, consisting of six rows, was cultivated on the same lines as No. 1, and also planted on 4th November. The same manures were applied as to No. 1 plot, with an additional 12½ lb. of nitrate of soda. One month later another 12½ lb. of nitrate of soda was used to test the effect on the swelling and ripening of the fruit. This proved very successful. The average manure applied per row was 16 lb. The ground in this plot had been used for tomato-growing for two years with good results, the season now dealt with being the third. The plot received one dressing only.

The average yield was 1,080 lb. per row and 7½ lb. per plant, the total crop being 6,480 lb.

NO. 3 PLOT.

Four rows. Cultivation and planting was carried out similarly to Nos. 1 and 2. The manure used consisted of 16 lb. mixed bonedust, 20 lb. superphosphate, 4 lb. sulphate of ammonia. The plants made very weak growth and were disappointing. It was necessary in January to give a second dressing of 12 lb. superphosphate, and 8 lb. bonedust to assist the swelling of the top fruit-trusses ; a third dressing, consisting of 2¼ lb. superphosphate, 2 lb. bonedust, ½ lb. ammonia, and ¼ lb. potash per row, was applied in February. 20 lb. of manure was applied per row.

Average crop per row, 936 lb., average per plant, 6¼ lb. ; total yield of four rows, 3,744 lb.

GENERAL.

The season throughout was dry, with cold winds prevailing. This checked the growth of the tomatoes, and caused a fair amount of damage when the plants were small. However, the plants soon picked up, and in No. 2 plot, with the additional 25 lb. of nitrate of soda, good results were obtained, the dry weather suiting the nitrate admirably.

As the above concluded this series of manurial tests, I would take the opportunity of again thanking Mr. Brasell for the great trouble and interest he has taken to carry out the trials for the information of growers in general. It may be added that he is one of the most successful growers in the Lower Hutt district.

PREVENTION OF WEEDS.

A. HUGHES.

ONE of the most important considerations in connection with the problem of weeds is their prevention. Before the suppression of weeds can be intelligently dealt with it is essential to have a clear conception of the manner in which weeds obtain access to the farm and the methods by which they are spread broadcast amongst cultivated crops.

The ways of distribution are many and varied—by self-sown seed, by winged seed, by weeds in manure, by the sowing of impure seed, and by self-division, &c. Self-sown seed is, of course, the natural method of propagation of nearly all plants. With annuals this takes place in the first year of their growth, and they usually produce a large amount of seed, afterwards dying completely down. These plants form a large percentage of the whole. There are also biennials, such as hemlock and foxglove, and perennials, such as ox-eye daisy, knapweed, and yarrow, which, although not supposed to produce as many seeds each time as the annuals, yet leave far too many descendants behind. Other seeds, such as the thistle, dandelion, dock, groundsel, &c., are supplied with flight-organs or wings, and are distributed by the wind, as are also the very small and light seeds.

Very often weeds are thrown on the dung-heap in the belief that they will decay there. Many may, but others do not, and these are distributed with the manure over the paddocks. The refuse from threshing-mills is also often thrown on the manure-heap, or is given to the poultry, instead of being burned. The use of impure seed and of inferior fodder, chaff, hay, &c., is also responsible to a great extent for the distribution of weeds.

Any firm or individual found to supply impure seed or weed-infested fodder should be most carefully avoided.

Californian thistle, hoary-cress, toad-flax, couch-grass, &c., are propagated by self-division as well as by seed — that is, they send out underground roots from the nodes of which leaves are given off again. Such operations as ploughing and harrowing simply cut up the plant into many parts, each one of which is capable of developing into a fresh plant.

Some seeds are provided with little hooks by means of which they may attach themselves to the wool and fur of animals. A great number of weeds are distributed in this way. There is very little doubt tha the only known patch of true Capeweed (*Cryptostemma calendulaceum*) known to be in the South Island was brought over from the North Island in the wool of some sheep.

The seeds of some weeds are eaten by animals and birds, and pass through the alimentary system unharmed, and are deposited in the droppings, maybe a long distance from their original home. Birds often carry the seeds of fruit, such as blackberry, brier, &c., to favourable positions to eat them at leisure, and either leave them or drop them on the way. There are other ways by which weed-seeds are distributed, such as by being washed down rivers or flooded streams, &c.

As prevention is better than cure, the first measure towards getting rid of weeds is to prevent them seeding, and to do this the weeds should be cut down or uprooted before they flower. If the weeds are only annuals, with a little perseverance the land may soon be cleared. If annual weeds in cultivated land are well kept down until the crop is of a good height they can easily be kept in check afterwards, and a good working after the crop has been removed will often free the land entirely of weeds, either annual or perennial. This is without doubt one of the best protections against weeds which a farmer can take. Autumn cultivation is especially valuable, as it exposes the roots of the weeds to the frost, and thus destroys them. Fallowing is also of much value. Owing to the repeated ploughing and harrowing which the land receives weed-seeds germinate and, being constantly disturbed, are prevented from establishing themselves.

The growth of a dense crop, such as lucerne, largely tends to suppress weeds, for once the crop gets established it chokes the weeds, and as it is cut during the summer months the weeds are cut with it and are not given a chance to seed.

Sowing clean seed is imperative. To give an instance of what impure seed may mean: it has been calculated that one per cent. of dock-seed in a mixture is sufficient to grow ten or more dock-plants to the square yard all over the sown area.

SCORE-CARDS FOR JUDGING FRUIT.

WITH the object of establishing a more uniform system of judging fruit at the various competitions held throughout the Dominion, the model score-cards printed below, which have been compiled by a special committee of Orchard Instructors of the Department, representing Canterbury, Otago, North Auckland, Whangarei, and Hawke's Bay, are recommended for general adoption by societies interested in such competitions.

SCORE-CARD FOR JUDGING FRUIT.

Class No. *Exhibit No.*

	Maximum Points.	Points awarded.
Correct naming	5	
Size	10	
Typical form	5	
Flavour	15	
Colour	15	
Market value of variety ..	15	
Storage and transportation	20	
Freedom from blemish ..	10	
Appearance of exhibit ..	5	
Total	100	

SCORE-CARD FOR CASED FRUIT.

Class No. *Exhibit No.*

	Maximum Points.	Points awarded.
Typical form	5	
Size	5	
Storage, transportation, and market value	25	
Colour and appearance ..	15	
Uniformity of grade ..	15	
Correct weight	10	
Alignment	10	
Compactness	15	
Total	100	

SCORE-CARD FOR FRUIT-PACKING COMPETITIONS.

	Maximum Points.	Points awarded.
Wrapping and handling ..	15	
Alignment	10	
Compactness	20	
General appearance ..	15	
Correct weight	10	
Time	30	
Total	100	

Annual Sheep Returns.—Supplementary returns received since the publication of the main statement show a further 77,027 sheep, thus making a total of 24,901,411 sheep in the Dominion as at 1st April last.

LIMESTONE-GRINDING MACHINERY.

B. C. ASTON, F.I.C.

IN the *Journal* for April, 1914, the writer gave some particulars concerning the types of reducing-machinery for making ground limestone (carbonate of lime). During the last eighteen months experiments have been carried out by the Public Works Department at Otira with the "Lightning" machine (Richardson, McCabe, and Co., Wellington, agents) described in the *Journal*. Mr. R. W. Holmes, Engineer-in-Chief of the Public Works Department, has kindly agreed to the publication of the report printed below, which he has made at my request, on the trials in grinding different limestones for agricultural purposes. It only remains for me to say that limestone crushed to these degrees of fineness would be quite suitable for application to the land.

I recently visited the Mauriceville Limeworks, and the manager, Mr. Dryden, reports that the Hardy Patent Pick Company's "Devil Disintegrator" (Messrs. Butcher, Reed, and Co., Ltd., Wellington, agents) is still used for grinding thoroughly kiln-dried limestone. The Mauriceville stone is, however, a fairly porous one and is easily reduced.

Messrs. John Chambers and Sons, Wellington, inform me that they will exhibit their portable machine (figured in the same *Journal* issue mentioned) at the Palmerston North Show in November, and are endeavouring to arrange for a crushing test to be made on the showground.

REPORT ON "LIGHTNING" CRUSHER AT OTIRA.

For experimental purposes a sample of Mount Somers limestone was passed through the crusher at Otira, with the results shown in the accompanying table. The stone contained 8 per cent. of moisture. The rate of crushing was 3 tons per hour. It will be observed that the percentage of moisture is somewhat high, and as the presence of moisture has a prejudicial effect upon the rate of crushing, it is probable that if the stone were dried in the sun before being crushed the quantity dealt with would be considerably increased.

A sample of crushed limestone was received from England, and its fineness is also indicated. As a sample of the stone which was crushed was not sent, the result is not of very great value, as it cannot be compared for hardness with the Mount Somers stone.

In order to obtain further information, I had a sample of Greymouth limestone sent to Otira and put through the crusher, the result being that 3 tons 16 cwt. was put through in an hour. The bars were spaced $\frac{7}{32}$ in. apart, and the result of the crushing is shown in the table herewith. It will be observed that the product is very much coarser, on the whole, than that of the Mount Somers sample. The Greymouth limestone is very much harder than the Mount Somers stone. On the other hand, I believe it contains a considerable proportion of mud and siliceous matter, which, of course, would detract from its value.

It is estimated that the cost of dealing with the Greymouth limestone in the machine is about 1s. 4d. per ton, while the cost of quarrying the stone and reducing it to between 2 in. and 2½ in. gauge by preliminary crushing is about 2s. 8d. per ton, making the total cost of the finished product 4s. per ton at the quarry, including interest and depreciation on the plant.

Comparing the limestones obtainable from the Manawatu Gorge, Mauriceville, and north of Nga-awa-purua Bridge over the Manawatu River, I am of opinion that no difficulty should be experienced in putting them through at a greater rate, and so considerably reducing the cost.

MOUNT SOMERS LIMESTONE.—CRUSHED AT OTIRA IN "LIGHTNING" CRUSHER.

Retained on $\frac{9}{64}$ in. mesh								2·00
Passed $\frac{9}{64}$ in. and retained on 20 mesh								25·71
,,	20*	(400)	and retained on	30	(900)			10·38
,,	30	(900)	,,	50	(2,500)			12·57
,,	50	(2,500)	,,	76	(5,776)			11·86
,,	76	(5,776)	,,	90	(8,100)			8·86
,,	90	(8,100)	,,	120	(14,400)			12·66
,,	120	(14,400)	,,	180	(32,400)			1·57
,,	180	(32,400)	,,					14·39
								100·00

ENGLISH LIMESTONE.—CRUSHED IN ENGLAND.

Passed $\frac{9}{64}$ in. and retained on 20 mesh								23·32
,,	20	(400)	and retained on	30	(900)			14·10
,,	30	(900)	,,	50	(2,500)			14·70
,,	50	(2,500)	,,	76	(5,776)			8·54
,,	76	(5,776)	,,	120	(14,400)			12·09
,,	120	(14,400)	,,	180	(32,400)			1·09
,,	180	(32,400)	,,					26·16
								100·00

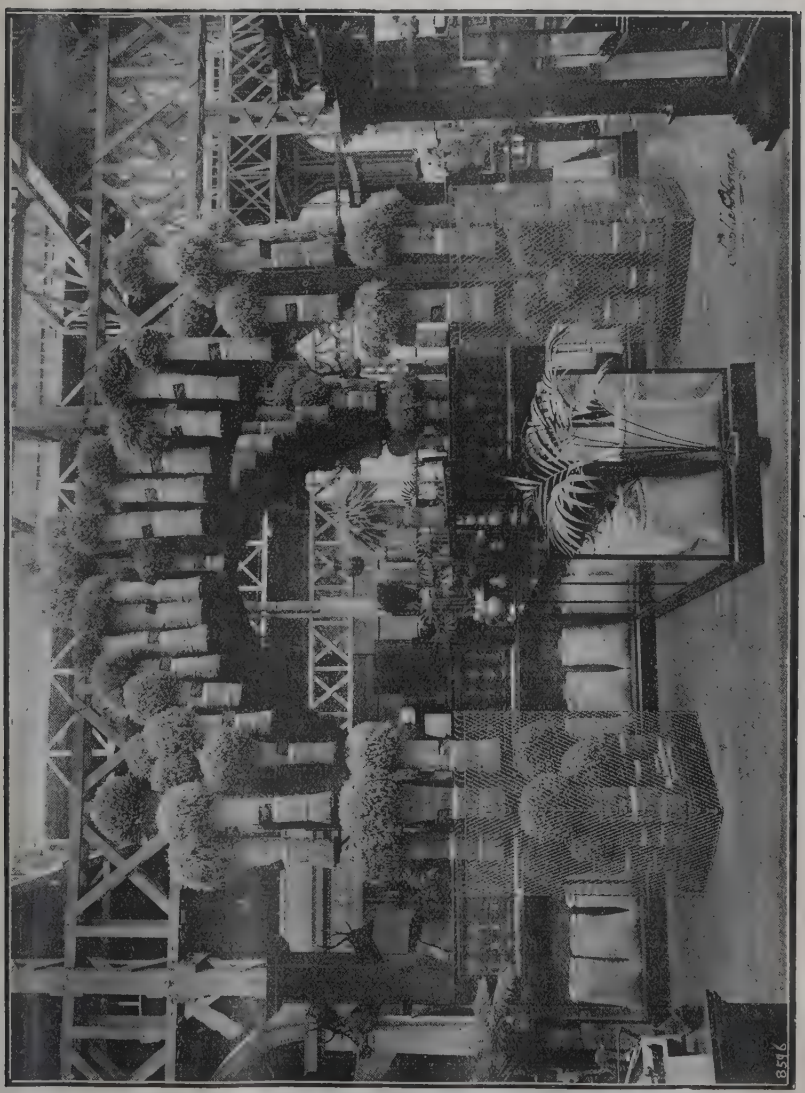
GREYMOUTH LIMESTONE.—CRUSHED AT OTIRA IN "LIGHTNING" CRUSHER.

Retained on $\frac{7}{32}$ in. mesh								3·55
Passed $\frac{7}{32}$ in. and retained on $\frac{9}{64}$ in. mesh								11·65
,,	20	(400)	and retained on	30	(900)			38·30
,,	30	(900)	,,	50	(2,500)			8·95
,,	50	(2,500)	,,	76	(5,776)			8·85
,,	76	(5,776)	,,	90	(8,100)			4·85
,,	90	(8,100)	,,	120	(14,400)			4·80
,,	120	(14,400)	,,	180	(32,400)			6·35
,,	180	(32,400)	,,					12·70
								100·00

* The figures 20, 30, 50, &c., refer to the number of meshes to the linear inch; those in parentheses give the corresponding number of meshes per square inch.

EXHIBITION IN FORMOSA.

THE Department has been advised by the Japanese Consul-General at Sydney that an industrial exhibition, promoted by the Governor of Formosa, is to be held at Taihoku, Formosa, from the 10th April to the 9th May, 1916. Cordial invitations to exhibit products are extended to South China, Hong Kong, the Commonwealth of Australia, the Dominion of New Zealand, British India, Dutch India, French India, Siam, and the Philippine Islands. Intending exhibitors are requested to communicate to the Governor of Formosa as early as possible particulars of the exhibits, area of space, and nature of stands required. All articles of exhibition will be admitted free of Customs duty, and the use of floor-space, stands, &c., will be free. For those who desire to erect buildings or annexes special facilities will be given.



CEREALS EXHIBIT IN NEW ZEALAND COURT, PALACE OF AGRICULTURE, PANAMA PACIFIC EXHIBITION.

TRADE-MARKS.

HINTS TO PRODUCERS.

E. S. BALDWIN.*

THE great amount of business which came before the Fruitgrowers' Conference recently held in Wellington precluded giving the meeting information relating to trade-marks, a matter which concerns growers in connection with their case-brands. The mere registration of a trade-mark is a simple matter, but it may prevent some fruitgrowers' and other producers from wasting their money and from getting into trouble if an indication is given as to the steps they should take and what they should avoid with regard to such marks or brands.

A trade-mark is used upon goods to enable the purchaser readily to recognize some particular produce or manufacture, and thereby have some assurance of the quality and characteristic features of the produce or goods to which the trade-mark or brand is applied. Such is equally the case whether the person whose trade-mark is in question be the actual producer or maker, or a person or firm of admitted skill or repute in the selection of goods.

The importance and value of a trade-mark are very great, as its use upon certain goods can be exclusively restricted to a particular producer or manufacturer or dealer, and enables him to retain and increase his custom and maintain the repute which his skill and enterprise have gained; and beyond this it is a protection to the public, because they are enabled to associate produce or goods with the manufacturers, merchants, or firms from whom they emanate. Hence the exclusive right in a trade-mark as applied to certain produce or goods forms a valuable asset and property which should not be disregarded by any enterprising firm.

It is necessary to register a trade-mark if a manufacturer, producer, or trader desires to retain its use exclusively; for if a mark is so registered an action at law can be taken against imitators merely upon the grounds that the trade-mark has been infringed. Persons who do not register their trade-marks must rely for any

* As a fruitgrower Mr. Baldwin was one of the Wellington-Moutere delegates at the conference of the New Zealand Fruitgrowers' Federation in August last.

protection they can get upon an action at common law for the prevention of fraud. An action of this kind is cumbersome and intricate, involving proof that the imitator is acting with fraudulent intent to deceive the public, or in such a manner that the effect of fraud is produced and that damage has been sustained by reason of the fraud.

There are other serious difficulties which may arise from the use of an unregistered trade-mark. For instance, I have known several cases where a mark has been properly used for some time by a trader without registering it, and subsequently another trader has innocently adopted and registered the same mark. The position of the first trader in the circumstances is most unsatisfactory, as he may have either to cease using his own trade-mark or find himself involved in costly legal proceedings in defending an action for infringement or in bringing an action in the Supreme Court for the removal of the mark from the Register.

Heavy penalties are imposable for falsely representing that a trade-mark has been registered in New Zealand or that an expired trade-mark registration subsists therein.

The duration of registration of a trade-mark commences from the date when the registration is applied for, and the registration when effected remains in force for fourteen years without payment of further fees. Renewal of registration can be effected for a further period of fourteen years, and thereafter for succeeding periods of fourteen years indefinitely.

The conditions necessary to entitle a trade-mark to registration, as prescribed by the Patents, Designs, and Trade-marks Act, 1911, are difficult of interpretation to the unpractised mind, and registration is refused of a large number of marks upon the ground of non-compliance therewith. Before commencing to use a mark it is therefore both necessary and expedient to make sure that it is registrable. It has frequently happened that a person has had labels printed and spent money in advertising only to find that his mark could not be registered.

A mark may consist of any of the following essential particulars: (1) The name of a company, individual, or firm represented in a special or particular manner; (2) the signature of the applicant for registration, or some predecessor in his business; (3) an invented word or invented words; (4) a word or words having no direct reference to the character or quality of the goods, and not being, according to its ordinary signification, a geographical name or a surname; (5) any other distinctive mark; but a name, signature, or word or words other than such as fall within the preceding

descriptions cannot, except by order of the Court, be deemed a distinctive mark.

Persons choosing a trade-mark should therefore be careful not to select a word which has a geographical significance, a reference to the character or quality of the goods, or is a surname. Thus, the word "Jonathan" would not be registrable owing to its being a person's name. "Cox's Orange Pippin" would be bad for two reasons: it contains a person's name and has a reference to the quality or character of the goods. There are many other reasons why a trade-mark cannot be registered.

A declaration of nationality is now required by every applicant for registration, and this requirement will remain in force until the end of the present war.

TRADING WITH THE ENEMY.

"TRADING with the enemy" has been the subject of legislation and Orders in Council at intervals during the past fourteen months throughout the British Empire. The phraseology of law is very seldom simple, and is frequently unintelligible to the lay mind. It has been found advisable in this instance to supplement Orders in Council by definite and precise warnings and explanations, giving to business men in straightforward language instances of the way in which traders may in all good faith undertake business of an illegal character and so get into trouble.

EXPORTS AND IMPORTS.

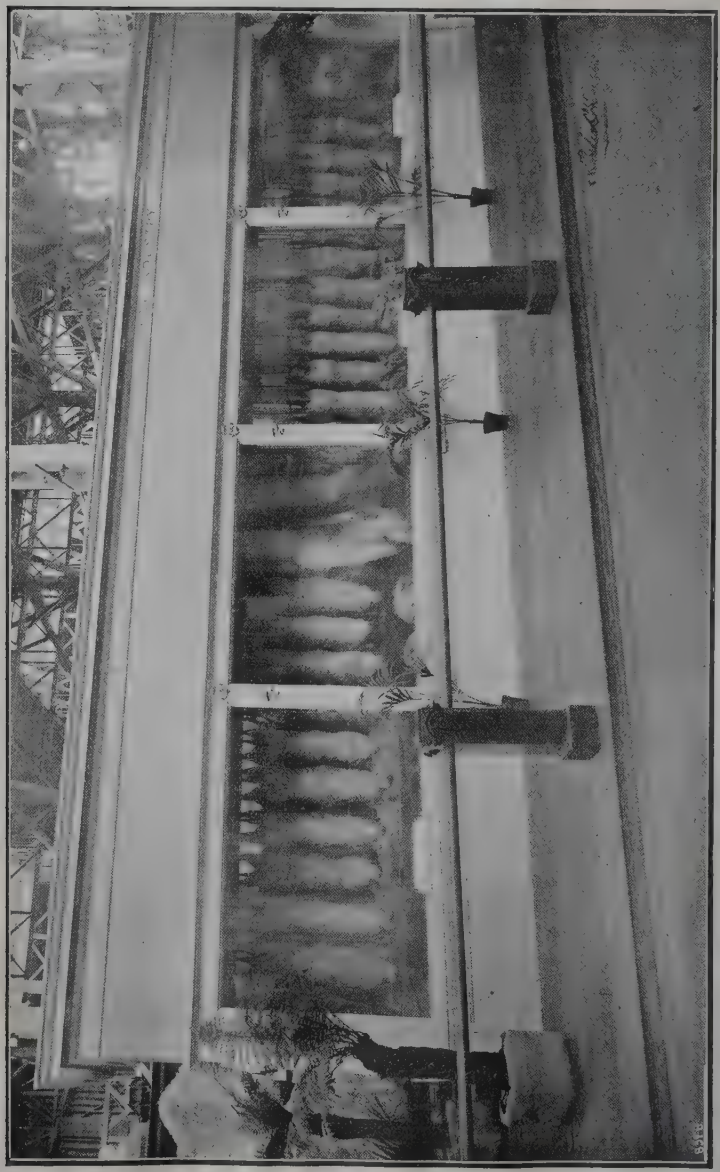
The warnings issued in London have referred principally to exports, and have taken the form of instructions to exporters that they should open no new accounts for any class of goods with firms in neutral countries without close investigation as to the *bona fides* of the buyer and the ultimate destination of the goods. It may be difficult to do so; it may even be impossible: that does not alter the fact that the responsibility rests with the exporter, and if he cannot satisfy himself that the business offered is within the four corners of the law he should let it go past him. The same considerations apply to imports. No goods of any kind should be bought from firms in neutral countries unless the importer is satisfied as to the *bona fides* of

the seller and the origin of the goods. Verbal and written guarantees should be regarded as valueless.

So far as firms in New Zealand are concerned, the question really narrows itself down to imports. The exports which are not going direct to the United Kingdom, or at least to normal and well-known destinations within the Empire or in America, are not considerable in bulk. The warning to scrutinize carefully every inquiry from an unknown firm in a neutral country is sufficient. With imports the case is different. There is a large number of diverse commodities which in the past have been imported regularly from Germany and Austria. Such are upholstery fabrics, glassware, cotton hosiery and woven underwear, enamelled hollow-ware, bentwood furniture, toys, fancy leather goods, asbestos slates, Plauen lace and embroideries. Most of these were of very low quality and price, and neutral countries, such as America, made no more effort to compete than did England, but bought their supplies from Germany. Direct offers of such goods from neutral countries would naturally seem suspicious, and should in fact be regarded as such.

INDENTS: CAUTION NEEDED.

It is, however, indirect offers against which our traders need to be on their guard. A large proportion of orders are not sent Home direct, but are given to indent agents or commission merchants. These latter may be well known to the indentor, and so not regarded with suspicion. Samples are shown, for instance, of "Swiss," "Dutch," or "Danish" goods by the agent, say, of an American merchant. The firm is invited to give an indent for some line which it badly needs. It does so, and regards the transaction as in reality between itself and the agent. The order is sent away and the goods are shipped, say, from New York or Amsterdam. But the goods are shipped direct to the indentor, not to the agent, and payment has to be made direct by the indentor. In the common everyday transactions of this kind it is necessary that all importers who give indents in this way, "direct-importing" retailers as well as merchants, should realize that on them lies the responsibility of ascertaining the exact origin of the goods ordered for them by the agent. If the goods prove on arrival to be of enemy origin it is useless to expect to shelter behind the agent. The responsibility for trading with the enemy lies primarily on the importer who receives the goods and pays for them.



NEW ZEALAND MEAT IN REFRIGERATOR, PALACE OF AGRICULTURE, PANAMA-PACIFIC EXHIBITION.

WORK FOR THE COMING MONTH.

NEW ZEALAND is a country of wide variation in climatic and soil conditions. In applying suggested procedure it is, therefore, necessary for the farmer to amend it to suit local weather-conditions and the requirements of his soil—information which can best be ascertained by a study of these problems on the part of the farmer himself. Nothing can take the place of local knowledge. Little advice on an agricultural subject is capable of general application in its entirety.

THE FARM.

DAIRY stock have now calved down in most districts, and the milking season will shortly be in full swing. Certain districts excepted, pastures are generally abundant, if somewhat soft. Where any hay is left over it may be used to advantage in overcoming the laxative tendency of the young grass.

Calves require careful feeding and attention at this time. Clean fresh yards and water, with good shelter, are essential for their well-being. The question of fat-substitutes crops up again. Perhaps the simplest solution to the problem is to make up a porridge that will keep several days for addition to separated milk. The following recipe is suggested: Mix together by volume 1 part linseed-meal, 2 parts oatmeal, and 4 parts maizemeal. Add 1 gallon water to each quart of meal, and boil for 15 minutes. This porridge will keep several days. Feed as follows: First week, whole milk only; second and third weeks, 3 pints whole milk and 1 pint porridge at each of three meals; fourth and fifth weeks, 2 pints whole milk and 2 pints porridge at each of three meals; sixth and seventh weeks, 1 pint whole milk, 3 pints porridge twice daily; eighth to sixteenth week, 2 quarts porridge twice daily. Always warm the milk before feeding, and feed regularly.

In many parts sows have been timed to farrow down at this season. In rearing the young pigs, pollard and separated milk is perhaps the best diet for both sow and youngsters. In the case of young sows and very old sows low in condition it is advisable to continue feeding in this liberal way for a week or more beyond the weaning-time, so as to bring them in better form to the boar.

SOILING-CROPS.

J. DRYSDALE.

A number of inquiries having been received regarding soiling-crops for dairy farms, a few remarks dealing with the subject should be timely. The return from the herd can be readily increased by supplementing the pasture with partial soiling-crops or, in other words, with green fodders, for any part of the season, as occasion may require.

The animal's constitution demands the first profit from whatever food is consumed; the scales and Babcock tester decide the owner's profit. If this is so, judging by the appearance of many dairy herds the owner's profit must be very small. Testing may be carried out under conditions which are not satisfactory to the cow nor to the owner's pocket. The individuality of the cow as a milk and butter-fat producer can never be realized while she is in a poor, starved condition; the scales and tester may condemn what would under more favourable conditions prove a most valuable animal. By the aid of soiling-crops animals can be maintained in a more even condition, and a sudden drop in the returns does not take place when the pastures fail. In the absence of such crops it is hardly possible for the farmer to maintain his stock in a good profitable condition throughout the whole year. When he depends wholly on pasture, particularly old pasture, he depends on the season; if the season should prove unfavourable the animal suffers, the owner suffers, and the returns are disappointing. Unfortunately the provision of sufficient food for the animal is very usually looked upon as too costly, and as a practice that can only be taken up by the Government farms or the farmer who has a substantial banking account.

The object of soiling-crops is to keep the animals abundantly supplied with green nutritious feed after the pastures have lost much of their succulence, even although the herbage should still be abundant. This is most important where milk-production is the chief object. Inquiries have been received as to what acreage would be necessary for a given number of cows under the partial-soiling system. A hard-and-fast rule cannot be laid down regarding area, as much will depend upon the climate and conditions, shelter from prevailing winds, quality of soil, and its suitability for growing crops that would produce the largest amount of feed per acre, such as maize, lucerne, rye-grass, Western Wolths, and mangels; also upon the condition of the field pasture, whether old or young.

I consider that old pasture on arable land is neither profitable nor desirable; the better grasses disappear, or at least do not give the early spring growth which is most important and necessary, no matter what top-dressing may have been carried out. In many cases top-dressing still further increases the life of undesirable grasses, besides which the grass becomes very dirty, particularly if harrows have not been made use of every winter to spread the droppings. Another objection and a serious danger connected with old pasture is that it becomes a hotbed for germs of diseases that all dairy herds are subject to—such as abortion, mammitis, tuberculosis, &c. Ploughing and renewing the grass lessens the evil in this direction.

The question of cost no doubt will be the first consideration, and rightly, too; but what about the profit? The question as to whether the operation will warrant the expenditure has been answered in the affirmative by those who have undertaken the expense of providing "meals at all hours" for their stock.

I would suggest the following cropping scheme for twenty cows:—

1 acre maize: sow beginning of November, feed from January to April.

8 acres White Russian barley and Italian rye-grass or Western Wolths: sow February, feed in April.

1 acre mangels: sow in October, feed with hay from June to September.

4 acres reserved for cutting for hay.

10 acres field pasture one year old, or not more than two years old, reserved from all stock grazing, at least during July and August.

Pasture of this description would be sufficiently forward in August, or September at latest, to carry the herd after mangel feeding was finished. The area under barley and Italian rye-grass, after being spelled during June and July, would be sufficiently recovered to produce a very large amount of valuable fodder. The 8 acres would be for grazing, to be fed off in suitable breaks to allow a continuous recovery and feeding. If cutting and carting to stock is preferred to grazing, 2 acres would be sufficient.

If the soil is suitable for the growing of lucerne, 1 acre should be sown in November, which, after becoming established, would be a valuable fodder to supplement all the other fodders if desired. Following are the variety of crops, quantities of seed and manure to sow per acre:—

Maize: If broadcast, not to exceed 2½ bushels; in rows 30 in. apart, 1 bushel per acre. Manure, 4 cwt. superphosphate per acre.

Barley, 2½ bushels; Italian rye-grass, 1 bushel; or Western Wolths, 10 lb. per acre. Manure, 2 cwt. superphosphate and 2 cwt. blood and bone.

Mangels (ridged): 5 lb. per acre. Manure, 2 cwt. basic slag and 2 cwt. superphosphate.

It should always be the aim in growing a soiling-crop to produce the largest quantity per acre possible, as with a successful crop for feeding purposes a little extra manure, seed, and labour is well repaid.

SOUTH ISLAND NOTES.

W. J. McCULLOCH.

Cereal crops for threshing, chaffing, &c., should be well advanced in the northern districts where the effect of the dry weather has not been too severe. Wheat, owing to its deep-rooted habit, resists periods of drought exceptionally well when once it covers the ground. Owing to its peculiar nature of growth, when tillering it may look very backward and disappointing where late sowing could not be avoided, especially in southern districts, or owing to the fact of its having had to follow a late feeding-off of turnips. If this is so, and the crop has previously been rolled, it should now receive a light stroke of the tine harrows. The former operation firms the soil about the roots and tends to assist moisture to rise from the lower depths, while the latter breaks the surface crust, aerates the soil, and creates a mulch which retains this moisture near the surface. If the crop is thin do not be afraid that a stroke of the harrows will make matters worse, for in every case the benefit derived will greatly exceed the harm done in removing a few plants. For backward wheat and oat crops a light dressing of nitrate of soda at the rate of ½ cwt. per acre may be beneficial, especially in the case of second successive white crops. The direct benefit of this procedure is being gauged by co-operative tests carried out this season by the Department throughout the South Island. Barley should not be top-dressed unless absolutely necessary, as this tends to destroy its malting qualities.

The sowing of mangels should be completed as early in November as possible. From the results of co-operative variety tests conducted in many districts in the South Island, the following are among the heaviest yielders: Sutton's Prize-winner Yellow Globe, Garton's Large Yellow Intermediate, New Zealand Farmer's Jersey Queen, and Montgomery's Half Sugar Giant White.

Silver-beet may now be sown. To obtain the most successful results it should be given land of fair quality, and, as the plant belongs to the same family as the mangel, it responds to a good dressing of a similar fertilizer. A suitable fertilizer for Canterbury soils would be (per acre): 1 cwt. superphosphate, ½ cwt. island guano, ½ cwt. dried blood, ¼ cwt. sulphate of potash, ¼ cwt. salt. For Otago and Southland a complete suitable manure would be—1 cwt. superphosphate, 2 cwt. island guano (or 1 cwt. guano and 1 cwt. basic slag), ½ cwt. dried blood, ¼ cwt. sulphate of potash, ¼ cwt. salt. The approved variety is dark-green leaf with silvery white midrib and of upright habit. Full particulars are given in a departmental bulletin on the subject.

The planting of the potato main crop should finish before the end of the month. The earlier-planted crops will derive benefit from a stroke of the harrows before they reach the surface, or, if too far advanced, should be scarified between the rows. This retards weed-growth and keeps the soil open and porous, a condition much appreciated by this crop. In districts where blight has to be contended with, the potato-grower should start early to spray. I merely mention the subject that it may be kept steadily in view, for it is too late to spray after the disease appears, and the very early patches may require spraying about the beginning of December. Timely spraying is undoubtedly effective, and without exception appears to lengthen the growing season. The formula is 4 lb. sulphate of copper, 4 lb. fresh lime, and 40 gallons of water. If good fresh lime cannot be got, use 5 lb. of washing-soda instead. In the case of second or third sprayings, where the foliage is toughened the sulphate of copper should be increased from 4 lb. to 6 lb.

Swedes should be sown as soon as the ground is prepared. This crop prefers a cool moist climate and good strong land well worked. Where it can be obtained, stable manure should be applied and worked in some time before sowing. If artificials are used, phosphates should predominate, as these are especially valuable in hurrying the young plants through the most critical period of growth, thus escaping the ravages of the fly and other insect pests. The swede being naturally a shallow-rooted plant, phosphates also assist its rooting propensities, and thus a greater area can be searched by the plant for food and moisture. A suitable fertilizer for average land in Otago and Southland would be 2 cwt. superphosphate and ½ cwt. bonedust per acre; for Canterbury 1½ cwt. superphosphate and 28 lb. bonedust per acre. Where the soil is deficient in lime or of an acid nature basic superphosphate should be used. In co-operative tests conducted by the Depart-

ment in the South Island the following varieties have proved to be the heaviest yielders: Garton's Superlative and Incomparable, Sutton's Crimson King and Magnum Bonum, Montgomery's Skirvings Purple-top, Webb's New Empire, Watson's Ne Plus Ultra, and New Zealand Farmers' John Bull. In dry ground, where ridged, it is advisable to roll the drills with a light roller after sowing.

Turnip land should receive its final working towards the end of November and be made ready for sowing in December. The last operation before sowing either turnips or swedes is to roll the ground.

Maize should be planted in well-worked soil during November. This crop is better planted in drills 3 ft. apart. If planted broadcast it should be lightly ploughed or disked in at about 2 bushels per acre. A suitable fertilizer on average land would be similar to that advised for swedes, with slightly more bonedust and supplemented with farmyard manure where possible. Among varieties tested in the South Island the following gave heaviest yields: Natal White Horse-tooth, Yellow Horse-tooth, Potchefstroom Pearl, and Red Cob Congo.

Where green fodders such as chou moellier, Buda kale, or thousand-headed kale which have been sown in drills are sufficiently advanced, they should be scarified and singled. As a cow-fodder chou moellier is excellent in a dry season, and does not taint the milk.

Rape and grass or turnips and grass may be sown well on into December. Where turnips are preferred, among the best white-fleshed varieties for early feeding are Garton's Hardy Green Globe, Sutton's Imperial Green Globe, and Montgomery's Lincolnshire Red Globe. These are most suitable for feeding off early with lambs.

Lucerne-sowing should be completed as early as possible, and where early sowing in rows has taken place and the plants are well above the ground the scarifier should be kept going if weeds appear.

THE ORCHARD.

J. A. CAMPBELL.

SPRAYING.

In the matter of spraying, whatever the disease or the season of the year at which it is being attacked, there are three essential points to be remembered: Spray thoroughly, spray at the right time, and spray with the right materials.

Codlin-moth.—In the control of codlin-moth spraying should be thoroughly done, and from the second application onward it should be carried out at regular intervals and at a slightly increased strength to that recommended for calyx-spraying, the object and method of application of which was fully dealt with last month. The period between the general setting of the fruit and the first appearance of the moth in the orchard varies slightly according to locality and climatic conditions. Mild weather, particularly if the nights are warm, favours early flights of moths. Under such conditions the moth may be found on the wing towards the end of the second week in November, but it is usually from five to ten days later than this before any indications of its presence are to be noticed in the orchard. The object aimed at in the control of the moth is to keep the fruit covered with a coating of the spray sufficiently strong to destroy the young grub during the period the moth is active. To do this it is necessary to apply the second spray just before or about the time the moth first appears, and to renew it at intervals of not more than three weeks throughout the season. The material recommended for this purpose is arsenate-of-lead paste at the rate of 1½ lb. to 2 lb. to 50 gallons of water, or arsenate-of-lead powder at a little more than half the above strengths.

Black-spot.—This disease is directly and indirectly responsible for a very large amount of damage to both apples and pears every season. The direct damage is in the form of actual outbreaks of the disease on the fruit, which are most to be feared during humid weather. Indirect damage, consisting of scorched foliage and spray-blemished fruit, often more serious than that caused by the disease itself, is the result of preventive measures adopted. To minimize the danger in both instances it is necessary to thoroughly attend to the winter and early spring spraying, and thereby lessen the necessity of drastic summer treatment. Avoid the use of Bordeaux mixture as much as possible during the summer, particularly on apples; but in cases where it has to be resorted to see that the materials used are pure and the mixture properly prepared. In place of Bordeaux mixture, lime-sulphur at the rate of 1 in 80 to 1 in 100 is recommended to be used in combination with arsenate of lead.

Powdery Mildew.—All diseased wood should be removed from trees affected with this disease, and frequent dressings of lime-sulphur at 1 in 80 to 1 in 100 applied, particularly during the early part of the season.

Mussel Scale.—This is one of the hardiest of the scale insects, the control of which necessitates thorough spraying during the dormant season with a strong oil emulsion. In cases where oil spraying has not been carried out, or where it has failed to give satisfaction owing to the mixture being too weak, kerosene emulsion should be used during the latter end of October and the beginning of November, when the young scale are hatching out. Lime-sulphur is also useful at this stage in the ratio of 1 in 60 to 1 in 70, although a little damage may be done to the foliage of some of the more tender varieties of trees.

CULTIVATION.

Thorough cultivation of the soil is an essential feature of successful orcharding. From now onward, throughout the summer, the surface of the soil should be kept free and loose. By so doing not only are weeds easily kept down by destroying them before they become firmly rooted in the ground, but a fine soil-mulch is formed and maintained throughout the period when a high state of evaporation is to be expected. Such conditions when properly maintained provide the only practical means of preventing or retarding the evaporation of the soil-moisture. More particularly does the importance of surface cultivation apply to those districts more or less subject to spring and summer droughts. How frequently this work should be done depends on the weather-conditions, but it should be thoroughly done at least once a month, and always after rains before a hard crust is formed, otherwise much of the benefit of the rain will be lost; moreover, the baking of the surface soil will add materially to the difficulties of subsequent fine cultivation.

DISBUDDING.

It will no doubt amply repay growers of young trees to devote a little time and attention to them during the month in the way of disbudding. This will consist mainly in rubbing off misplaced growths, and generally directing the flow of sap into those growths required to build up the tree. For instance, the sap usually flows more strongly to the upper buds. The upper buds are generally selected to form-up the tree, but there are exceptions to this rule, such exceptions being mainly brought about through injury. In such circumstances the flow of sap is diverted, and instead of the growth starting from the buds selected an altogether misplaced bud may begin to grow freely. Matters of this kind can be more readily dealt with where attended to early, and the earlier the better.

THE POULTRY-YARD.

F. C. BROWN.

THE last of the chickens should be hatched by the end of October, that is if they are to develop into profitable stock. Chickens hatched later than October generally make unsatisfactory growth, and the later the hatching the more disappointing are the results. Not only are they susceptible to all forms of disease, but they lay small eggs, and these mostly in the cheap-egg season; moreover, they never make good breeding-stock however good the strain. In many cases those who have to depend upon the natural mother to renew their stock are compelled to hatch chickens in the late season, owing to inability to secure broody hens at the right time. In such cases every means should be taken to provide good shade, good feeding, and an ample supply of green food; while grit, clean water or milk should be always available. It is only by careful management, even with early-maturing breeds, that they can possibly prove satisfactory stock.

OVERDUE HATCHES.

Many inquiries have reached me of late as to overdue hatches. The invariable cause is that the incubator has been maintained at too low a temperature. The thermometer may have been placed too high above the eggs, or the thermometer may not be accurate. If eggs do not pip up to time—say, at the beginning of the twentieth day for hen-eggs and the twenty-sixth day for duck-eggs—the only safe course to take in the following batch is to have the thermometer tested and to see that it is hung in the correct position, the bulb being allowed to rest against the top surface of an egg. Of course, an incorrect temperature may be secured from the reverse position, through the thermometer being too far below the level of the top of the eggs. When the correct degree of heat is spoken of it means the temperature required by the germ of the egg, which is always floating uppermost. To test a thermometer place a clinical thermometer and the one to be tested in water at 100°, stir gently, and add slowly at the same time hot water, and observe the difference in the readings. If the incubator thermometer reads, say, a degree lower or higher than that of the clinical it must be worked a degree higher or lower accordingly.

A BROODER TROUBLE.

A common trouble which usually affects chickens after being removed from the heated brooder is an inflammation of the veins.

It first makes its appearance in the hock-joints, which become discoloured. Then a gangrenous swelling follows. In a few days the wings become affected in a similar manner, and later the neck and head swell. At this stage death is not far off. The trouble is usually caused by overcrowding, damp quarters, and insufficient ventilation, and it is sometimes due to damp bedding, such as imperfectly dried hay, which heats and brings on a sweated condition. There is no cure for this trouble. It is merely a question of prevention: don't overcrowd, provide ample ventilation, keep the quarters clean and dry, and check everything that tends to create a moist atmosphere.

SITTING HENS.

Many inquiries have reached me of late in regard to poor results obtained from eggs set for hatching in the natural way. As most of these inquiries have come from the South Island, where dry weather is being experienced, it may be taken for granted that the necessary moisture under such conditions has not been supplied. This can be best done by keeping the soil under the nesting-material slightly moist. The object is not to wet the eggs but to create a moist atmosphere, so that the moisture shall be drawn by the heat of the fowl's body to the eggs.

OVERCROWDING OF CHICKENS.

Overcrowding is probably the most common mistake made in the management of young stock after they leave the heated brooder. Overcrowding in itself is bad enough, but where combined with filthy quarters it is not to be wondered at that heavy mortality takes place under such conditions. It is surprising how some breeders go on year after year losing their chickens in large numbers, and contenting themselves with the idea that some mysterious disease over which they have no control is responsible. The blame is usually attributed to bad luck, but there is no bad luck about it. In practically all the brooder troubles I have investigated I have never found the case of an epidemic form of disease. All the troubles have been the result of mismanagement. A case in point came under my notice the other day. A poultryman complained that for many seasons he lost the greater part of the chickens hatched when about five weeks old. When I saw the conditions I was not surprised. The chickens had been taken from the heated brooder before they were a month old, and crowded into small dirty boxes, these being placed on the floor of a dark unhealthy fowlhouse in which a large number of adult birds were

roosting. Apart from this, the house had not been cleaned out for months, and was overrun with red mites.

It is useless taking every care of chickens up to a month old and then placing them at such a disadvantage as described. Crowded stock of any kind can never give the best account of themselves, but with young growing chickens the restriction of sleeping and exercising quarters is merely inviting trouble. I cannot urge too strongly the necessity for cleanliness; everything should be kept as clean and sweet as possible. Again, the incubator chicken, by careful management, should reach maturity without having to fight vermin. It is next to impossible for young chickens to make the best growth if the quarters are infested with parasitic life, especially the red mite. The only way of fighting these vermin is to prevent them. The quarters must be kept thoroughly clean, and frequently sprayed with a strong solution of sheep-dip.

For the successful rearing of chickens good feeding is always essential, but this is only one link in the chain. Good feeding and good management must go hand in hand. The main object of the breeder should be to rear his stock in such a way that they never get the slightest set-back from the day they leave the incubator until they reach maturity. Thousands of chicks are lost every season by reason of huddling in corners, as a result of being moved too soon from the brooder or to an unsuitable colony house. When no special accommodation is provided for the chickens after they leave the brooder they are liable to be affected by the change. They will huddle together in the corners, each one trying to get an inside position, which is necessarily the warmest, and instead of the chickens resting they are constantly on the move, with the result that they get into a sweated state, which is fatal to chickens at any time.

A good preventive of this trouble is a temporary hover. All that is needed for this is a light wooden frame on legs, with a curtain of sacking round the four sides and hanging about 2 in. from the ground, the lower half being cut in strips. In addition, a light frame covered with loosely woven scrim is required to drop just inside the open top. This is kept in position by nailing pieces of wood about 1 in. square about 2 in. below the top on the inside of the larger frame. When the chickens are first put under the hover temporary boards should be placed at the sides and ends of the frame to prevent them leaving the hover and huddling in the corners of the house. After the second night the little ones, as a general rule, settle down under the hover without

being compelled to by the use of boards. There is, of course, no bottom in the frame, but the earth where it stands should be dry and covered with chaff, sawdust, pine-needles, or other suitable material. In a cool brooder-house it is always advisable to have the corners rounded off with wire netting, so that in the event of crowding fresh air may be available for the chickens at the back. The chickens will take to the hover much better if it is placed in a corner, but on no account should this be done unless the corners are rounded with wire netting.

THINGS TO REMEMBER.

Do not allow young stock to run with the adult stock: there are few old birds that are quite free from vermin.

For keeping vermin in check a good coating of tar on the walls of the house is invaluable.

When droppings are seen sticking to the feathers on the chickens' backs it indicates that they have been huddling, and that more heat is required in the brooder-box.

Select the best males from the early broods to head next season's breeding-pens: the late-hatched cockerel seldom makes a desirable breeding-bird.

At no time of the year will vermin multiply as they will in the warmer months of summer. To keep them in check continued vigilance is therefore imperative at the present time.

It is generally advocated, "Don't overfeed the laying hen." The right advice would be, "You cannot overfeed the laying hen, if the food is of the right quality."

The presence of vermin, delay in setting a hen after she becomes broody, continual disturbances by other hens, and making use of non-sitting breeds are common causes of hens forsaking their nest before the end of hatching-period.

Do not delay in marking the feet of chickens when they are a few months old. It is the only means whereby the common mistake of sending a young profitable bird to market and retaining an old unprofitable one may be obviated with certainty.

To prevent red mites getting on the birds, perches are sometimes suspended by wires away from the walls, but so close that the feathers of the birds touch the walls. This is fighting the mite on one hand and encouraging it on the other.

THE APIARY.

F. A. JACOBSEN.

SWARMING AND ITS PREVENTION.

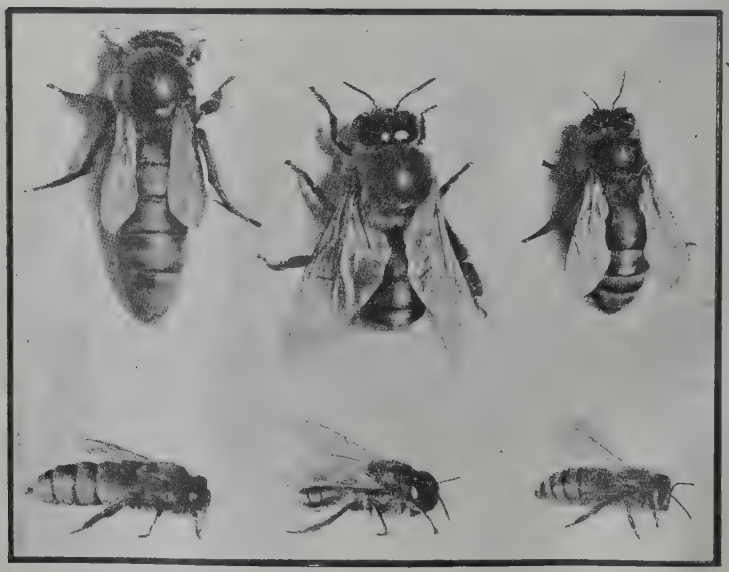
DR. MILLER, an American authority, says, "If any one expects to be told of an easy way to prevent swarming, let him stop right there"; and the wisdom of this remark has been noted by the best beekeepers, who have given up the thought of some sleight-of-hand method that would accomplish the desired end. Frequent examinations of the colonies—every week or ten days during the swarming season, which has now arrived again—for the purpose of cutting out queen-cells is a help; but this requires considerable work, and since it frequently fails in spite of every care it is not usually relied on.

The occurrence of swarming is largely due to overcrowded brood-chambers; hence give the queen plenty of room to lay. A suitable plan is to give a new brood-chamber comprising two drawn combs and the rest frames of foundation. Secure the queen and confine her in this new chamber below a queen-excluder, placing the old brood-nests directly above, thus giving additional work for the young bees and plenty of room for the queen to lay. If for some reason this plan is not desirable, the brood may be equalized by robbing the stronger colonies for the benefit of the weaker. This latter plan is specially recommended for out-apiaries.

A young queen in the hive is an outstanding factor of success, as bees are rarely inclined to swarm with a young queen if they have *reared her themselves under natural conditions*. This feature, however, is not always satisfactory to the beekeeper, as he frequently buys young queens in large numbers from a queen-breeder, kills the older ones, and introduces the younger. He still has to contend against the swarming impulse, although in a lesser degree. A beekeeper rearing his own stock should select not only prolific queens to produce from, but those that have previously shown the least tendency to swarm. There are also other reasons why young queens should be employed, and the practice of introducing them in the spring before the swarming season commences, at intervals of not longer than two years, is a very excellent one. Autumn introduction is also commendable, as the full tide of a queen's maturity is gained from the commencement of the following spring. In order to follow the lives of the mothers as

closely as possible and avoid mistakes, some system of recording the various ages must be employed; in addition, notes should be taken of their general behaviour, such as tendency to swarm, prolificness, gentleness, &c. Such notes will prove of great value in selecting a mother of future queens.

Ventilation also plays an important part in controlling the natural inclination to swarming, and care should be taken to provide sufficient at all times of the season. A well-known and effective



QUEEN, DRONE, AND WORKER OF THE HONEY-BEE.
(Gleanings in Bee Culture.)

method is to place blocks 1 in. in height under the two front corners of the brood-chamber. In the very flush of the honey-flow additional ventilation may be given by drawing one of the supers forward over the rest, which forms two additional entrances and permits the workers to escape to the field without having to traverse the whole depth of the hive.

No single system will be found universally effective, and different beekeepers advocate different methods. Climatic conditions also frequently play an important part in bee-behaviour. It will,

however, be found that the methods here given, or variations of the same, employed either singly or in combination, will materially assist in the prevention of swarming.

PREVENTION OF AFTER-SWARMING.

In many cases a prime or first swarm is desirable, and in others they often issue in spite of all precautions. It is a simple matter to hive the swarm, but to combat the results in the parent colony arising from this condition entails special action. Persistent after-swarming is one of the discouraging features of natural increase, and is often hard to stop. Many practical beekeepers rely on the method of cutting out all queen-cells but one, but this is sometimes a failure. Another plan is to place the swarm on the old location, removing the parent colony to a new stand some distance away. The immediate result is for all the flying bees to join the swarm, and thus the parent colony is still further weakened; this encourages them to tear down all queen-cells but one, or to destroy all embryo queens after the first young queen has emerged from her cell. If the shifting plan is adopted and all queen-cells but one removed from the hive, this will provide the bees with an additional inducement to cease further swarming.

QUEEN-REARING.

The queen-rearing branch of the industry should now be claiming the attention of those beekeepers who intend to rear queens. Advice and general information on this important subject will be found in the *Journal* for September and October, 1912, and April, 1913. For economic reasons it is strongly recommended to requeen colonies at a period of not longer than two years; hence the necessity of deciding at an early date the method to be employed during the coming summer, and of making suitable arrangements and plans for the work.

THE FARM GARDEN.

W. H. TAYLOR.

VEGETABLE-CULTURE.

THE main crop of *parsnips* and *carrots* may now be put in. It has been explained before why these roots should not be sown on and freshly manured with animal manure. A patch that was well

manured last season will suit them best, and no further manure will be required; but if the quantity of manure previously used was not very great, some addition judiciously applied is advisable. Both parsnip-seed and carrot-seed should be thinly sown. The fewer superfluous plants there are the less will be the labour of thinning, and, what is perhaps of even greater importance, the less will be the danger in neglecting to thin them in time.

Peas are still to be sown at intervals of two weeks. As the weather gets warmer I prefer to sow a little deeper, the seed being thus better protected from the effect of the hot sun. Thinner sowings than required earlier in the season are now advisable. One pint of peas of medium-height varieties will at this time make a well-furnished row of 40 yards, some 10 more than for earlier sowings.

Turnips should be sown about every eight weeks. Where birds are troublesome some protection is required. Birds often pull up the seedlings as soon as they show, and eat the germ, which at that stage is sweet. The seed is not often interfered with, but it is a good plan to roll it in red-lead moistened slightly with water, or, better still, immerse it for an hour or so in turpentine, the taint of which left in the ground is some protection. A light dusting with hellebore powder is sufficient protection for the seedlings.

Radish seeds should be rolled in red-lead to protect them from birds, which are very partial to them. Radishes should be sown twice a month.

Broccoli and *Brussels sprouts* should be up before this. If not sown, get the seed in at once. Both require a long period of growth to prove satisfactory. *Savoy* seed may be sown now.

A late-summer crop of *cabbages* and *cauliflowers* may be secured by sowing seed at once. Cauliflowers will require well-manured soil at the time of the year when their growth will be made. Growth should be rapid, or stunted plants and small heads will result. The variety used must be an early one of the Early London type. If, however, a giant kind has already been sown, there will be no use for the sowing just mentioned, as an early sort sown now will come in at the same time as the giant kind sown earlier—about Easter-time.

French beans are now to be regularly sown. If properly gathered —none being allowed to get old—each crop should last from four to five weeks. Therefore, if sufficient be put in each time, a sowing once a month will suffice.

Runner beans should be in by now. If not, plant them at once. Plant in rich soil in alternate rows, so that the seeds are about 6 in. apart.

Vegetable marrows, *pumpkins*, *cucumbers*, and various kinds of *melon* may be sown in the open ground during October in northern districts; early in November in other parts. Though these plants do not require a great deal of rich manure, moisture-holding humus is a necessity. Where requirements are small they do very well indeed on heaps of garden rubbish and manure heaps, thus converting an otherwise unsightly heap into a thing of some beauty. A few spits of soil should be thrown on the heap to receive the seed. It has been noticed that, though these plants luxuriate on a heap of stable manure, the roots do not penetrate far, merely running over the surface in the rain-washed and aerated portion.

Lettuce.—Sow in lines, and thin the plants.

Tomato plants should be well hardened off prior to planting. Much of the future success of the crop depends on this. There is a very marked difference in the appearance of the properly raised and hardened plant to the drawn, spindly, weak plant which is more or less commonly used, and which subsequently fails to give the maximum of success. When planting, each plant should have a good ball of soil attached to its root, and should be let down into the soil to the first joint. Water at the time of planting is not required: the plants will root much better without it. Plant at a distance of a little less than 3 ft. apart.

SMALL FRUITS.

Gooseberries.—The bush should not be allowed to be overdense, the inconvenience in gathering the crop alone necessitating this; moreover, the berries, which will undoubtedly be numerous on the densely crowded bush, will be small and inferior in comparison with those of the more open bush. Soft shoots likely to be detrimental in crowding the growth, where not required for replacing older growths, should be rubbed off. This can be done with little trouble whilst young, and will save a considerable amount of subsequent labour.

Red and White Currants.—All strong shoots appearing in the heart of the bush should be entirely removed; other shoots appearing should be stopped at 6 in. in order to force the formation of spurs.

Black currants should be allowed to retain all the shoots they make, providing they are not too numerous, in which case reasonable thinning out is necessary in order to prevent overcrowding.

Cape gooseberries can now be planted. At this stage it is necessary to risk the danger of frost in order to avoid being too late.

Raspberries.—Surplus suckers should be checked. They can be easily dealt with whilst young. Cultivation should be frequently carried out for the purpose of retaining moisture and to keep down weeds.

THE HEMP INDUSTRY.

W. H. FERRIS.

SOME improvement has been noticeable in the quality of the hemp forwarded for shipment during the past month from Manawatu mills. Wairarapa, Marlborough, Westland, Canterbury, and Southland maintained a fibre of good quality, having apparently consistently worked to a good-fair standard, and in some cases to a fine grade. In this they were assisted by having a supply of good leaf. In many instances in these districts the leaf has been sorted into different lengths. This sound practice not only means better and more uniform stripping and more effective scutching, but greater uniformity in the baled fibre. Besides the increased commercial value of the latter there is less waste in the milling process, a saving which more than compensates for slightly increased cost of production.

The flax grub or caterpillar has again made its appearance in the Manawatu district, and is working havoc in some phormium areas, making it practically impossible for millers working the affected flax to secure a good-fair grade; while the broken character of the fibre leads to an increase in the quantity of tow produced and a deterioration in its quality. It is to be regretted that many millers do not realize the importance of keeping really badly diseased leaf apart from the better quality. They should not overlook the fact that the value of the line must be determined by the inferior portion. That is the principle on which the manufacturing trade buys its raw material, and it is a principle which must be largely observed in the work of grading.

If prices are maintained the season's output should constitute a record. Practically all mills in the Manawatu are working at full pressure, and the supply of leaf is abundant.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in these columns must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

CONTROL OF RAGWORT.

"SUBSCRIBER," Tuakau :—

Would you kindly inform me the best means of killing ragwort on a good grass paddock? I do not want to plough up the paddock if it can be got rid of without doing so.

The Fields Division :—

If the area infested is not too extensive, control of ragwort can be obtained by cutting or pulling up before flowering. Pulling is the best method. This may require to be repeated twice or three times in certain seasons. Grazing sheep on the land tends to control the plant, and this system is suitable for large areas. Sheep fatten on the plant, but should not be confined too long on ragwort-infested land, or injurious effects may be manifested.

LOCKJAW IN LAMBS.

H. S., Nelson :—

I have lost several lambs as late as six weeks after tailing. A lamb in fat condition without any signs of inflammation from tailing assumed the symptoms of lockjaw, a rigid state of the body, lying down and bleating until starved.

The Live-stock Division :—

There is no doubt that the lamb died from tetanus or lockjaw, for which treatment would be unavailing. Prevention is the remedy, and precautions must be taken at the time of docking. We would advise you to dock your lambs in a clean paddock and not in the sheep-yards. All knives and instruments should, before using, be boiled for ten minutes, and a 5-per-cent. solution of a non-poisonous sheep-dip applied to all wounds. Another precautionary measure is not to allow horses to run for at least a month in the same paddock in which you intend to put your docked lambs, as the organism of tetanus is found in horsedung. Tetanus usually appears when wounds are nearly healed, but the incubation of the organism is from a few hours to two months.

CROPS FOR PIGS.

"SUBSCRIBER," Evansdale :—

Would you kindly say what is the best root crop to grow for feeding young pigs from two to six months old, and what is the most fattening crop for use just before "topping off"? The soil is medium to light with a clay subsoil.

The Fields Division :—

Rape is probably the best crop to turn pigs on. For later use satisfactory results are obtained by growing turnips, swedes, mangels, and field-peas. Stack the field-peas alongside the feed-yard, and fork over as required, the roots being fed at the same time.

WOOD-LICE IN STRAWBERRY-BED.

"FARMER," Opouiti :—

I have a strawberry-bed which is full of wood-lice and other grubs all round the plants, and when the berries are ripe the lice and other grubs eat the fruit. Kindly let me know if it is advisable to spread lime to kill the pest, or other cure.

The Horticulture Division :—

In order to control this pest we would advise you to keep the plot well worked and free from litter, and apply light dressings of kainit. Some of the commercial manurial insecticides might be beneficial in such cases.

FOWL MANURE.

"SUBSCRIBER," Nelson :—

Could you tell me the best way to mix fowl manure with sand for a fertilizer, and in what proportions? Would this manure be as good as blood-and-bone for top-dressing potatoes, cabbages, &c.?

The Fields Division :—

You will gain nothing, from a fertilizing point of view, by mixing fowl manure with sand. Apply the manure along the rows and work in. Fowl manure is much poorer than blood-and-bone in nitrogen and phosphate, but has the advantage of from 1 to 1½ per cent. of potash. It is a first-class manure for the crops you mention.

PIGS EATING THEIR LITTERS.

A. L. B., Norsewood :—

A great number of sows in this district have been eating their litters this spring. Is there any diet recommended that will check the appetite?

The Live-stock Division :—

We should advise you to give the sows a small quantity of coal-cinders or charcoal once or twice a week. By so doing you will have your pigs in better health and thereby minimize the trouble.

PEAS FOR POULTRY.

"SUBSCRIBER," Bunnythorpe :—

Will you please state what is the difference in feeding-value to poultry between the White Pearl and the Grey Partridge pea? I notice the fowls are much fonder of the latter.

The Live-stock Division :—

The feeding-value of each variety may be regarded as virtually the same. Seeing, however, that the fowls prefer the Partridge pea, it is only reasonable to assume that these suit the birds' requirements better than the Pearl pea.

THE EVERGREEN OAK.

M. D. M., Tauranga :—

Is the prickly evergreen oak suitable for hedge or shelter trees, and what is the nature of its growth?

The Horticulture Division :—

The European evergreen oak (*Quercus ilex*) is a fairly fast-growing, ornamental, and excellent shelter-tree. This is probably the variety you refer to. Besides being hardy, its timber is useful for many purposes.

PIG-MANAGEMENT.

ANDREW VELLA, Mana Island :—

I have thirty breeding-sows running with sheep and cattle here. Is it a fact that sheep and cattle do not do well running on the same ground as pigs? Will one boar be enough for the above number of sows?

The Live-stock Division :—

Pigs should be kept by themselves and not allowed to run with cattle or sheep. Pigs often contract the habit of sucking the cows, and cases have been known where this was the means of cows being completely spoiled by pigs sucking them and biting their teats. Anybody who knows what mischief a savage old sow will do amongst lambs will see that they are kept by themselves. The boar, too, is all the better for being kept in a small run by himself, and the sows taken to him after they have been in heat a day or two. After two services the sow should be removed. This will be as effective as half a dozen matings, and will conserve the strength of the boar. If this practice is carried out a vigorous boar will serve fifty pigs, but it is not advised to give him more than thirty if he is to run out with them.

FRUIT-PLANTING.—WATTLE SHELTER.

S. H. W., New Lynn, Auckland :—

Will you please give me some information in regard to—

1. Growing stock for apples: if from cuttings, how deep to plant, and how many buds to leave above ground.

2. The best treatment for swamp land preparatory to planting lemons. The swamp can be easily and well drained. If lime is recommended, would carbonate of lime be as good as burnt lime?

3. Last year I sowed a lot of *Acacia decurrens* for temporary shelter, and, except where it came up very thick, instead of growing up straight it crept along the ground until it was a foot or more long, then commenced to grow upwards. Could you tell me the reason for its growing thus?

The Horticulture Division :—

1. Apple-stocks are usually raised by root-grafting or by layering; a blight-proof variety, the Northern Spy, is commonly used. Previous year's wood of the Spy is whip-grafted on to a section of Spy root. Subsequently, usually in January or February of the second summer, this stock is budded with a selected variety. Apple-stocks can of course be raised from pips or cuttings, but the foregoing is the general and most satisfactory method.

2. The success of citrus culture depends largely on good drainage. A thorough system of pipe drainage should be carried out. Break up the land well and deeply with the plough. Dress with lime, 15 cwt. of burnt lime or 1 ton of carbonate of lime to the acre. Sow a cover-crop of oats or barley in February or March. Work this in in late autumn or early spring. Break the soil down well with the disks before planting the trees.

3. Erect growth is the natural habit of the young wattle. However, the peculiarity of growth referred to does sometimes occur, and is probably caused through damage by wind or disease.

COUCH-GRASS.

ANDREW VELLA, Mana Island :—

Could you tell me if couch-grass is of any use as sheep-feed ? If it is of no use, could you suggest a way of killing it ? I have ploughed some paddocks with it, but the ploughing seems to thicken the roots.

The Fields Division :—

Couch-grass (*Triticum repens*) provides some feed for sheep, but is better suited for cattle. It is, however, a grass, or rather weed, that one is well rid of, unless under soil and climatic conditions not suited for better grasses. Its underground rootstocks take possession of the soil and exhaust it. The only way to get rid of couch is to summer fallow, and follow in autumn with heavily seeded smother-crops of rape, mustard, or buckwheat. A dry hot summer is decidedly in favour of this treatment. Plough the ground fairly deeply, and frequently cultivate throughout the summer months with spring-tooth cultivator and tine-harrows, and rake the couch into heaps and burn. When you have diligently carried out this frequent and thorough tillage seed heavily with one of the above-mentioned smother-crops. The growth from this usually chokes out the remaining life of the couch. Merely ploughing and letting it lie encourages its growth, for it cultivates it, and by slicing the sward promotes new centres for the matted growth. If the area is comparatively small a good practice is to put in potatoes, the cleaning and digging of which, if systematically conducted, will eradicate the couch. In this, as in the larger area, much depends upon your climate or season, however.

TOMATO-CULTURE.

"INQUIRER," Whangarei :—

1. For house tomatoes, what range of temperatures night and day are most desirable ?

2. Regarding humidity : your issue of 20/10/14 mentions 70 per cent. as satisfactory. Am I right in assuming that this means that humidity should be kept about 70 per cent. during the heat of the day, but that this percentage does not refer to the condition of the air during the cooler hours of the night ?

3. For dissolving potassium sulphide, I read directions to use varying quantities of hot water. Is hot water an essential, or merely a quicker solvent ? Is the efficacy of the solution affected by dissolving in a small quantity of hot water and then diluting with cold ?

4. *Re* "flowers of sulphur" : I understand that in the ordinary state it is useless as a fungicide. What chemical change takes place after dusting to produce the fungicide ? The information I am seeking is to know whether the under-sides of the leaves require dusting—that is, whether the sulphur only becomes effective where it is in contact, or whether such chemical changes result as to make its presence in the vicinity sufficient.

The Horticulture Division :—

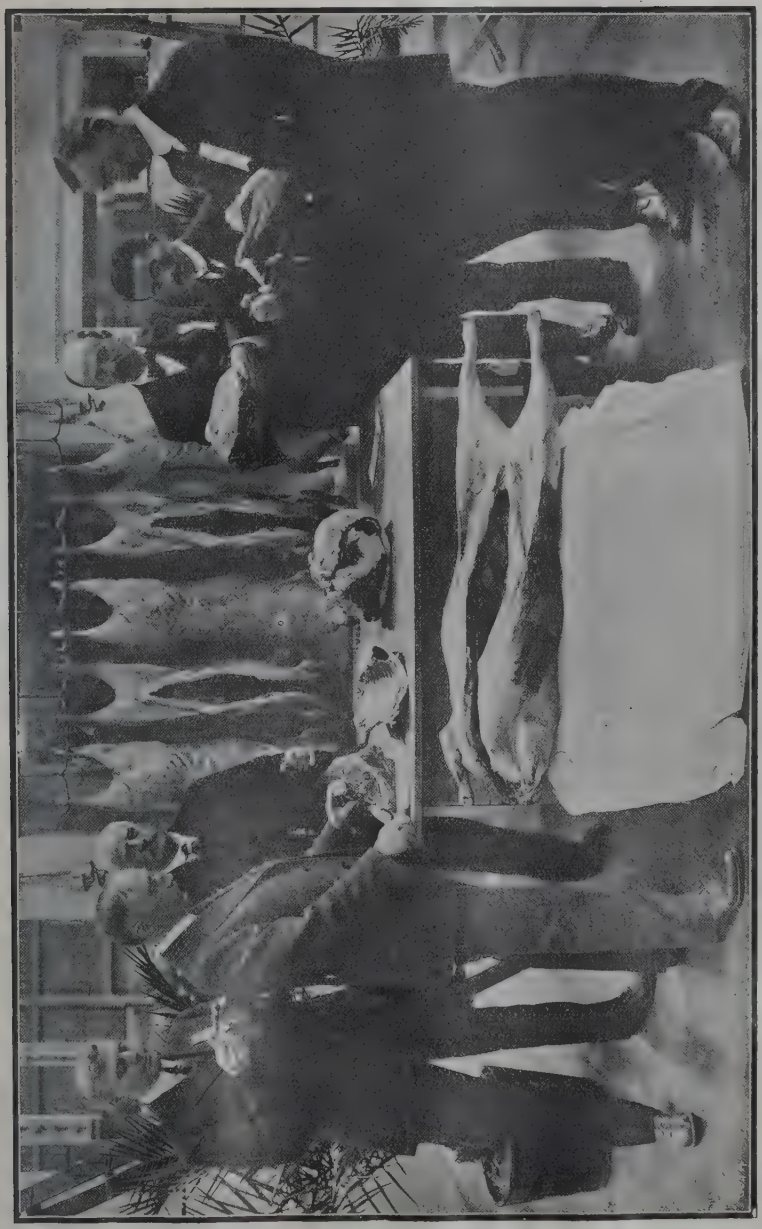
1. A departmental leaflet on tomato-culture, giving the maximum and minimum temperatures suitable in tomato-culture, has been forwarded to you.

2. Seventy per cent. humidity should not be exceeded at any time. This is not likely to occur during the cooler hours of the night.

3. Hot water is used in dissolving potassium sulphide merely as a solvent, and does not affect the efficacy of the solution.

4. Flowers of sulphur oxidizes when exposed to the air ; the fumes arising constitute the fungicidal value of sulphur when applied in this form. It is therefore not actually necessary to cover all parts of the plant. Sulphur in a more finely divided form, such as lime-sulphur solution, atomic sulphur, or sulphide of iron, applied in the form of a spray is now considered more effective. In this case all parts of the plant should be covered.

NOTICE.—The postal address of "Economy," Bellvue, is required.—ED.



JURORS EXAMINING NEW ZEALAND MEAT, PANAMA PACIFIC EXHIBITION.

COMMERCIAL INTELLIGENCE.

COCKSFOOT-SEED.

THERE is every indication that the 1916 cocksfoot-seed crop will be an extremely small one. The main usual source of supply is Banks Peninsula where, roughly, nearly 30,000 acres are harvested. This season, owing largely to shortage of feed, the area shut up for seed has been much restricted, and, apart from this, the average yield will be much smaller than usual. Every year, however, very large quantities of cocksfoot-seed mature on what may be termed waste land, such as roadsides, railway-lines, and more especially the unutilized places on individual farms. Ordinarily the monetary inducement to harvest odd areas of cocksfoot-seed is not sufficiently great to encourage the collection of such seed. This season, however, the price that will be offered for farmers' lines should induce a more complete collection from these usually unavailed-of sources of supply.

A shortage of cocksfoot-seed in New Zealand must be looked upon almost in the nature of a calamity. Cocksfoot and rye-grass form the two main seeds used in pasture formation, and when one considers that in the North Island alone over a quarter of a million acres is annually laid down in permanent pasture, a shortage of such an essential as cocksfoot-seed is a serious matter. So far as the 1916 sowings are concerned, a fair supply of seed will be available, but unless special efforts are made to collect as much seed as possible this season the 1917 sowings will be seriously threatened. It might be thought that a shortage could be avoided by importation from overseas, as has been done recently, but the main outside source of seed—namely, Denmark—is now virtually closed so far as further supplies are concerned. The freight on a light seed like cocksfoot is also now exceedingly high.

It is difficult to forecast what will be the prices ruling later on in the season, but there is every indication that the present retail price of well over 1s. a pound will harden considerably. A good deal will depend, however, on how much cocksfoot-collecting takes place on areas where hitherto the seed has been allowed to fall to the ground. If the whole of the available seed is harvested this season, then there will be adequate supplies for both 1916 and 1917, but if this is not done there will be a serious shortage and the price will soar to a figure greater than has ever previously been reached.—*A. H. Cockayne.*

THE WORLD'S WHEAT-SUPPLY.

SIR J. WILSON, K.C.S.I., delegate of Great Britain (and of New Zealand) to the International Institute of Agriculture at Rome, has continued to prepare periodical statements analysing the wheat position. In the latest note to hand, dated 30th July, he further advances the view that supplies of wheat will be ample, and that probably before long prices will fall to a level very little above average values before the war. The following is a digest of the statement:—

On the average of five years ending July, 1914, India, United States, and Canada exported 68·4 millions of the total net exports of wheat from all the countries of the world—namely, 170 million quintals.* This year, if the estimates of the total yield of this season's harvest turn out correct, and the home requirements of these countries are much the same as they were on the average of the past five years, then these countries will be able to supply 167 millions of the 170 million quintals ordinarily required for the world's total annual net exports.

If the possible exports from other exporting countries—namely, the Russian Empire, Roumania, Argentine, Australia, New Zealand, Bulgaria, Algeria, and Chile—be taken into account, merely estimating that their harvest this year will be equal to the average of past years, it is probable that these countries will have available for export during the twelve months ending July, 1916, a total of 101 million quintals, which is the average of their actual exports during the five years

* A quintal of wheat is equal to 13·67 bushels, or rather less than half a quarter.

ending July, 1914. These figures, added to the exportable surplus of India, the United States, and Canada, give a total exportable surplus for all countries in the world of 268·2 quintals.

By the term "available for export" and "exportable surplus" it is not meant that the amount estimated will actually be exported. What is meant is that if each country actually reaps this year the estimated quantity of wheat, and retains for its home requirements the same quantity as it did retain on the average of the five years ending July, 1914, it will have over a surplus of the estimated amount, which it could export without depriving itself of the quantity of wheat it ordinarily requires, and which it would be glad to export if it could get a satisfactory price for it.

During the twelve months ending July, 1916, war or no war, the importing countries taken together are not likely to purchase from abroad as much as 170 million quintals of wheat, unless its price to them goes down below the old average; while, on the other hand, the exporting countries taken together are likely to be able to spare and to be anxious to sell during those twelve months more than 268 million quintals. Further, they will compete with each other in selling their surplus wheat much more than they have had to do during the past twelve months. It is now very probable that the world, as a whole, will have a much larger wheat-yield this year than it ever had. All these great exporters will probably be strong competitors in selling in the world's wheat-markets, and will have more wheat which they will be anxious to sell than they ever had before, and, taken together, very much more than the importing countries will wish to buy. It therefore seems very probable that the world's price of wheat will soon fall to about the normal average of the five years before the war, or even lower.

If owing to war-conditions the whole of the surplus of the Russian Empire and of Roumania remains cut off from the rest of the world, there will still be an exportable surplus from other countries whose ports are open of 209 million quintals. On the other hand, if Germany, Belgium, and Austria-Hungary are unable to import from the countries whose ports are open any part of the 35 million quintals which form their average demand from abroad, then the effective demand from the other importing countries of the world will be only 135 million (170 less 35) quintals; whereas the exporting countries whose ports are open will have, as above estimated, 209 million quintals to send them. So that in the case supposed the world's price of wheat seems likely to fall almost as much as it would if peace were declared at an early date. Of course, if, while the war continues, the Dardanelles are opened to trade and the whole surplus of Russia and Roumania from this year's harvest, estimated at 59 million quintals plus any surplus of old wheat they may have over from last year's harvest, becomes available for export, the fall of price is likely to be still more marked and more rapid.

The cost of freight and insurance from New York to Liverpool is 3·30 francs per quintal (say, 6s. per quarter) more than it was in July last year. Other things being equal, this extra cost of freight and insurance would tend to raise the price in the importing market and to depress the price in the exporting market. There therefore seems to be good reason to expect that, whether the war continues or not, the price of wheat in the exporting countries will sooner or later fall below what it was in July last year, just before the war, and that its price in the importing countries will sooner or later, after allowing for the increase of cost of freight and insurance, fall to something not much above what it was at that time. Whether the fall will come soon or late in the next twelve months will depend partly on weather-conditions in the world generally, partly on the urgency of the importing countries to buy, and on the urgency of the exporting countries to sell. The importing countries, having their own harvests to depend on for the time being, and having reason to expect a fall in the present price of wheat, are not likely to be in any hurry to buy. The exporting countries, having got accustomed to a high price of wheat, and being for the most part in a prosperous condition, may at first be in no hurry to sell. But when they realize that there is far more wheat in the world than there ever was before, and that the exportable surplus from several countries is larger than it ever was, and, taken together, much larger than the probable demand of the importing countries, it seems probable that there will be a very rapid fall in the price of wheat in the exporting countries, and therefore in the importing countries also. To put this estimate into figures, it seems more and more probable that before long the quoted price at Liverpool of such wheats as No. 2 Hard Winter, No. 2 Northern Manitoba, and Choice White Karachi may not be much above 40s. per quarter, as compared with the average price of 38s. per quarter in the month of July for the five years previous to the war.

NEW ZEALAND SHEEP AT THE PANAMA PACIFIC EXHIBITION.

By the s.s. "Marama," which left Wellington for San Francisco on the 16th September, there were shipped thirty-one head of New Zealand stud sheep, for competition and display in the live-stock competitions to be held in November in connection with the Panama Pacific Exhibition. The animals were accommodated in specially well-constructed pens in the stern of the vessel, and were accompanied by two New Zealand shepherds, who will tend the animals until the conclusion of the competitions. The whole of the arrangements were made by the Department on behalf of the owners.

The breeders who are participating at the Exhibition competitions, together with the sheep entered and shipped by them, are as follows :—

Mr. William Perry, Penrose, Masterton, four Romney rams and four Lincoln rams; Mr. Alfred Matthews, Wairongomai, Featherston, four Romney rams; Mr. J. W. Harding, Mount Vernon, Waipukurau, six Romney rams; Mr. G. E. Allen, Tipua, Masterton four Romney rams; Mr. D. G. Wright, Windermere, Winslow, four Romney rams; Mr. C. H. Ensor, White Rock, Rangiora, three Corriedale rams and two Corriedale ewes.

A cablegram has been received from the New Zealand Commissioner at San Francisco advising the arrival in good condition of the stock, with the exception of one of Mr. Allen's rams, which unfortunately died on the voyage.

IMPORTATIONS OF FRESH FRUIT.

The following table shows the varieties and quantities of fresh fruits imported into New Zealand at the several ports of inspection during the year ended 31st March, 1915. The figures represent cases.

Port of Inspection.	Oranges.	Mandarins.	Lemons.	Pines.	Passions.	Bananas.
Auckland ..	103,366	2,095	1,506	6,872	1,737	188,134
Wellington ..	43,766	5,322	8,536	5,035	3,380	55,671
Christchurch ..	24,228	1,539	3,006	2,021	1,258	26,849
Dunedin ..	20,466	569	3,314	1,648	862	26,984
Bluff	1,998	316	435	234	199	756
Totals ..	193,824	9,841	16,797	15,810	7,436	298,394

Port of Inspection.	Apples.	Pears.	Loquats.	Grapes.	Plums.	Cherries.
Auckland ..	26,363	199	270	51	240	2,149
Wellington ..	13,390	321	552	..	..	..
Christchurch ..	2,703	42	73	94	112	87
Dunedin ..	11,735	434	9	249	..	196
Bluff	2,055	790	..	3	..	319
Totals ..	56,246	1,786	904	397	352	2,751

The totals of all varieties imported at the several ports are as follow: Auckland, 332,982; Wellington, 135,973; Christchurch, 62,012; Dunedin, 66,466; Bluff, 7,105 cases. The grand total for the Dominion is 604,538 cases.

NEW ZEALAND EXPORTS TO BRITAIN.

COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Cases.
January,	1915	137,816	296,439	45,622	339	138,081	85,123	87,393	..	..	2,860	683	..	1,209
,,	*1914*	*231,766*	*464,185*	*30,424*	*33*	*150,492*	*136,086*	*108,742*	..	*500*	*2,851*	*15,234*	*4,306*	*11,133*
February,	1915	433,585	517,581	77,421	311	119,371	96,090	159,347	..	..	..	13,111	6,619	2,763
,,	*1914*	*354,190*	*334,207*	*14,100*	*3*	*86,570*	*59,532*	*127,372*	..	*4*	..	*3,709*	*633*	*7,607*
March,	1915	80,439	203,480	30,176	..	55,280	51,811	49,809	..	..	..	8,410	185	274
,,	*1914*	*446,522*	*551,313*	*36,689*	..	*61,060*	*62,732*	*95,175*	..	..	..	*8,187*	*2,562*	*3,958*
April,	1915	286,155	328,779	45,340	..	6,703	38,561	41,371	..	..	1,011	9,328	1,474	3,461
,,	*1914*	*234,765*	*366,786*	*22,185*	..	*7,822*	*63,796*	*58,488*	..	*2,901*	..	*1,247*	*888*	*5,909*
May,	1915	257,953	433,831	34,780	655	148	17,065	21,615	..	..	2,923	4,968	808	2,636
,,	*1914*	*336,632*	*638,397*	*39,315*	*54*	*837*	*37,776*	*43,364*	*3,623*	*11,062*	..	*8,355*	*2,112*	*9,316*
June,	1915	99,080	154,785	19,316	932	..	26,869	11,946	..	..	9,800	5,027	1,320	1,229
,,	*1914*	*261,877*	*634,981*	*36,400*	..	*1,153*	*19,247*	*18,774*	..	*28,141*	*1,000*	*7,924*	*4,258*	*7,881*
July,	1915	243,420	340,476	21,231	154	..	21,520	16,039	..	..	5,968	5,068	1,639	4,184
,,	*1914*	*225,411*	*239,143*	*38,170*	..	*1,355*	*2,003*	*15,868*	..	*1,425*	*1,000*	*5,810*	*2,584*	*8,053*
August,	1915	510,418	570,381	51,750	35	..	18,287	19,416	..	..	31,790	7,138	1,466	4,848
,,	*1914*	*84,251*	*63,111*	*19,094*	*516*	*1,979*	*50*	*4,845*	*600*	*38,220*	*10,403*	*367*	*245*	*3,705*
September,	1915	299,715	330,643	59,487	..	26,416	2,595	5,360	..	..	7,750	2,022	3,091	595
,,	*1914*	*53,386*	*49,200*	*2,353*	..	*15,885*	..	*3,337*	..	*5,896*	*7,288*	*1,143*	*57*	..
October,	1914	291,432	128,016	49,104	..	81,842	30,487	8,938	..	68,660	38,121	2,042	1,650	1,683
,,	*1913*	*14,122*	*25,735*	*580*	..	*42,847*	*21,452*	*2,705*	..	..	*10,020*	*6,986*	*3,672*	*2,923*
November,	1914	136,346	27,577	48,302	27	98,729	70,048	37,604	15	24,289	35,783	885	110	1,377
,,	*1913*	*20*	*1,479*	..	..	*53,468*	*23,722*	*1,891*	..	..	*2,478*	*4,162*	*771*	*2,314*
December,	1914	192,952	149,835	44,876	..	172,990	80,114	86,317	..	..	9,306	1,136	116	2,157
,,	*1913*	*128,087*	*86,890*	*8,909*	..	*249,526*	*124,821*	*51,385*	..	*250*	*24,479*	*19,807*	*5,276*	*11,273*

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops. 36's.	40's.	44's.	50's.	56's.	60's.	Mutton. Canterbury.	Lamb. North Island.	Lamb. Canterbury.	Lamb. Other than Canterbury.	Beef. New Zealand Hinds.	Beef. New Zealand Fores.	Butter. Danish.	Butter. New Zealand.	Cheese. New Zealand White.	Cheese. New Zealand Coloured.	Cheese. Canadian.	Hemp (Spot). New Zealand Good-fair.	Hemp (Spot). New Zealand Fair.	Hemp (Spot). Manila Fair (New Grade).	Hemp (Forward Shipment). New Zealand Good-fair.	Hemp (Forward Shipment). New Zealand Fair.	Hemp (Forward Shipment). Manila Fair (New Grade).	Wheat. Short-berried.	Wheat. Long-berried.	Oats. Sparrowbills.	Oats. Danish.
1915.							d.	d.	d.	d.	d.	d.															
July 10	..	..	..	..	..	..	7¼	7⅛	8½	8⅜	7½	6¾	158/0	..	93/0	92/0	88/0	32/0/0	30/0/0	37/0/0	31/0/0	29/10/0	36/10/0	..	..	..	..
,, 17	..	..	..	..	..	..	7¼	7⅛	8½	8⅜	..	..	160/0	..	84/0	82/0	84/0	31/10/0	29/10/0	..	31/0/0	29/0/0	36/10/0	..	..	..	..
,, 24	..	..	..	..	..	..	7 3/16	7	8⅜	8 5/16	..	..	166/0	..	78/0	76/0	76/0	31/10/0	29/10/0	..	31/0/0	29/0/0	36/0/0	..	..	..	..
,, 31	..	..	..	..	..	..	7⅛	7	8⅜	8¼	7½	6¾	166/0	..	76/0	74/0	76/0	31/10/0	29/10/0	..	..	..	36/0/0	..	..	..	..
Aug. 7	..	..	..	..	..	..	..	6 13/16	8¼	8⅛	..	..	170/0	..	76/0	75/0	76/0	32/0/0	30/0/0	..	31/10/0	29/10/0	37/0/0	..	..	..	..
,, 14	..	..	..	..	..	..	7	6 13/16	8 5/16	8 3/16	..	..	170/0	..	76/0	75/0	76/0	32/10/0	30/10/0	..	32/0/0	30/0/0	38/0/0	..	..	..	..
,, 21	..	..	..	..	..	..	..	..	8¼	8 3/16	..	..	169/0	..	75/0	74/0	75/0	32/10/0	30/10/0	..	32/10/0	30/10/0	38/0/0	..	..	..	..
,, 28	..	..	..	..	..	..	..	..	8⅛	8 3/16	7½	6½	165/0	..	73/0	72/0	74/0	32/0/0	30/0/0	..	32/0/0	30/0/0	38/0/0	..	..	..	..
Sept. 4	..	..	..	..	..	..	..	..	8⅛	8 1/16	..	..	168/0	..	75/0	74/0	76/0	32/0/0	30/0/0	..	32/0/0	30/0/0	38/10/0	..	..	..	..
,, 11	..	..	..	..	..	..	7⅜	..	8⅛	8 1/16	6½	6	175/0	..	76/0	75/0	76/0	33/10/0	31/10/0	40/0/0	33/0/0	32/0/0	38/10/0	..	..	..	..
,, 18	..	..	..	..	..	..	7⅜	..	8⅛	8⅛	6½	5¾	179/0	..	76/0	77/0	77/0	33/0/0	31/0/0	38/10/0	32/10/0	30/10/0	..	..	..	..	..
,, 25	1/11	1/11½	2/1	2/4	2/8	3/1	7⅜	..	8⅛	8⅛	..	..	192/0	..	77/0	76/0	77/0	33/10/0	31/10/0	..	33/0/0	31/0/0	38/10/0	..	..	..	..
Oct. 2	..	..	..	..	..	..	7⅜	..	8⅛	8⅛	6	5	197/0	..	76/0	77/0	77/0	..	..	..	..	..	38/10/0	..	..	..	..
,, 9	..	..	..	..	..	..	7⅜	..	8⅛	7⅞	..	..	207/0	..	76/0	77/0	77/0	33/0/0	31/0/0	38/0/0	..	..	..	..	..	..	..

NEW ZEALAND-VANCOUVER TRADE.

FOLLOWING are the shipments of produce from New Zealand for Vancouver and North American Pacific ports from May to September, 1915:—

—	"Niagara," 18th May.	"Makura," 15th June.	"Niagara," 13th July	"Makura," 9th Aug.	"Niagara," 7th Sept.
Butter, boxes	..	..	160	..	647
Mutton, carcases	..	..	..	..	..
Lamb, ,,	..	..	..	..	..
Beef, quarters—pieces	..	..	..	..	..
Veal, carcases	..	..	..	..	..
Frozen sundries, packages	..	..	7	..	12
Wool, bales	431	264	143	221	541
Grass-seeds, &c., sacks	..	..	43	..	..
Hides and skins, sacks, &c.	1,473	1,543	1,753	1,047	1,793
Onions, cases	..	..	..	..	..
Sheep-skins, bales	134	15	50	..	100
Jam, cases	..	..	120	..	..
Sundries, packages	17	..	23	2	92
Pelts, casks	..	..	..	..	73
Kauri-gum, packages	1,180	2,043	894	1,568	1,787
Hemp, bales	327	..	22	..	..
Rabbits, crates	..	..	2	..	..
Timber, pieces	..	..	..	..	..
Eggs, cases and crates	..	..	..	..	..
Meats (canned, &c.), cases	..	..	..	..	..
Cheese, crates	..	..	..	..	..
Fresh fruit, cases	..	..	..	..	..

NEW ZEALAND-SAN FRANCISCO TRADE.

FOLLOWING are the shipments of produce from New Zealand for San Francisco, Tahiti, and Rarotonga, and transhipments for Vancouver, from May to September, 1915:—

—	"Moana," 28th May.	"Marama," 24th June.	"Maitai," 22nd July.	"Moana," 19th Aug.	"Marama," 16th Sept.
Gum, packages	16	98	18	25	73
Milk, cases	..	..	..	1	..
Grain, &c., sacks	10	13	12	9	9
Meat, cases	60	50	50	65	71
Onions, cases	14	23	11	15	3
Potatoes, sacks	16	26	15	20	10
Sundries, packages	41	114	430	220	1,045
Butter, boxes	5	5	5	5	5
Hemp, bales	259	261	279	1,142	1,262
Frozen lamb, carcases	3	5	3	3	3
Hides and sheep-skins, sacks and bales	..	..	..	..	..
Beef, quarters—pieces	..	..	..	..	..
Veal, carcases	..	..	..	..	..
Cheese, crates	..	..	..	..	1
Peas, sacks	..	..	..	..	2,374

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of September, 1915:—

Port of Shipment.	Horses.			Sheep.			Cattle.			Pigs.		Dogs.	
	To Australia.	To Eastern Pacific.	To Montevideo.	To Australia.	To Eastern Pacific.	To Japan.	To Australia.	To Eastern Pacific.	To Norfolk Island.	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.
Auckland ..	27	28	..	..	410	..	..	12	1	..	78	..	..
Gisborne ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellington ..	3	..	..	..	..	..	..	..	..	..	..	..	..
Lyttelton ..	2	..	..	8	..	18	2	..	..	..	..	..	..
Dunedin ..	45	..	..	..	..	..	..	..	..	..	..	..	..
Bluff ..	10	..	..	..	..	..	..	..	..	..	..	..	..
Totals ..	87	28	..	8	410	18	2	12	1	..	78	..	..

The following are particulars of horses shipped: Draughts—3 stallions, 49 mares, 13 fillies, 17 colts; medium draughts—13 mares, 10 geldings; light draughts—1 mare; thoroughbreds—1 mare, 3 geldings; light—1 mare; trotting—1 colt; ponies—3 mares.

Auckland also shipped 8 crates of poultry to Pacific islands.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of September, 1915:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			MOTUIHI ISLAND (AUCKLAND).		
1	Yorkshire terrier	Male ..	Vancouver	H. V. Mooney ..	Auckland.
			SOMES ISLAND (WELLINGTON).		
4	Southdown rams	Male ..	London ..	Ellis Bros. ..	Bull's.
1	Southdown ewe	Female	,, ..	,, ..	,,
1	Boston bull-terrier	Male ..	New York ..	P. A. Maysmor ..	Wellington.
			QUAIL ISLAND (LYTTELTON).		
1	Southdown ram	Male ..	London ..	A. H. Bowen, c/o Pyne and Co.	Christchurch.

HEMP AND TOW GRADING RETURNS.

SEPTEMBER.

Hemp.—The total number of bales graded was 11,330, as compared with 5,816 for the corresponding month of last year, an increase of 5,514 bales. For the twelve months ending 30th September, 1915, the number of bales graded was 99,836, as compared with 121,124 for the previous twelve months, a decrease of 21,288 bales.

Tow.—During the month 2,891 bales were dealt with, as compared with 1,365 for the corresponding month of last year, an increase of 1,526 bales. For the twelve months ending 30th September, 1915, the number of bales graded was 26,796, as compared with 38,524 for the previous twelve months, a decrease of 11,728 bales.

Stripper-slips.—During the month the number of bales graded was 452, as compared with 72 for the corresponding month of last year, an increase of 380 bales. For the twelve months ending 30th September, 1915, the number of bales graded was 2,323 as compared with 3,239 for the previous twelve months, a decrease of 916 bales.

HEMP, TOW, AND STRIPPER-SLIPS GRADED THROUGHOUT THE DOMINION DURING THE MONTH OF SEPTEMBER, 1915.

Hemp.

Port.	Superior.	Fine.	Good-fair.	Fair.		Common.	Rejected.	Condemned.	Total.
				High Point.	Low Point.				
	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	..	68	473	849	127	61	24	1,602
Napier ..	..	..	..	..	..	..	..	..	..
Foxton ..	..	..	1,367	1,810	487	19	10	..	3,693
Wellington ..	..	..	1,370	2,961	509	68	35	32	4,975
Picton ..	..	76	26	..	..	..	..	..	102
Blenheim ..	..	40	209	..	..	..	..	..	249
Lyttelton ..	..	..	14	16	..	..	..	..	30
Dunedin ..	..	..	96	58	40	..	..	..	194
Bluff	..	..	192	239	38	16	..	..	485
Totals ..	..	116	3,342	5,557	1,923	230	106	56	11,330
Percentages of totals	..	1·02	29·50	49·05	16·96	2·03	0·94	0·50	..

Tow.

Port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	127	309	50	486
Napier	..	..	..	..	..
Foxton ..	279	442	62	..	783
Wellington ..	300	694	86	47	1,127
Picton	29	26	..	..	55
Blenheim ..	12	136	..	8	156
Lyttelton ..	..	72	..	..	72
Dunedin ..	..	5	17	..	22
Bluff	..	58	131	1	190
Totals ..	620	1,560	605	106	2,891

Stripper-slips. — Foxton: First grade, 8; second grade, 158; total, 166. Wellington: First grade, 3; Second grade, 269; total, 272. Blenheim: Second grade, 11. Bluff: Second grade, 3.

AGRICULTURAL SHOWS, 1915-1916 SEASON.

Hawke's Bay A. and P. Association: Spring Show at Hastings, 20th and 21st October.

Poverty Bay A. and P. Association: Annual Show at Gisborne, 26th and 27th October.

Marlborough A. and P. Association: Show at Blenheim, 26th and 27th October.

Timaru A. and P. Association: Jubilee Show at Timaru, 27th and 28th October.

Wairarapa and East Coast P. and A. Association: Annual Show at Carterton, 27th and 28th October.

Kelso A. and P. Association: Show at Kelso, 3rd November.

Manawatu and West Coast A. and P. Association: Spring Show at Palmerston North, 3rd, 4th, and 5th November.

Waimate A. and P. Association: Summer Show at Waimate, 4th November.

Canterbury A. and P. Association: Spring Show at Christchurch, 10th, 11th, and 12th November.

Bay of Islands P. and I. Association: Annual Show at Waimate North, 10th November.

Nelson A. and P. Association: Annual Show at Richmond, 16th and 17th Nov.

Courtenay A. and P. Association: Annual Show at Kirwee, 18th November.

Peninsula Horse Show and Pastoral Association: Annual Show at Duvauchelle, 18th November.

Winton A. and P. Association: Summer Show at Winton, 24th November.

Egmont A. and P. Association: Summer Show at Hawera, 24th and 25th Nov.

Otago A. and P. Association: Summer Show at Dunedin, 24th and 25th November.

Auckland A. and P. Association: Summer Show at Auckland, 26th and 27th November.

Stratford A. and P. Association: Summer Show at Stratford, 1st and 2nd Dec.

Palmerston and Waihemo A. and P. Association: Annual Show at Palmerston South, 3rd December.

Tauranga A. and P. Association: Show at Tauranga, 10th December.

Southland A. and P. Association: Show at Invercargill, 14th and 15th December.

Tuapeka Agricultural Society: Annual Show at Lawrence, 27th December

Waitahuna Farmers' Club: Annual Show at Waitahuna, 28th December.

Taieri Agricultural Society: Annual Show at Mosgiel, 20th January.

Woodville A. and P. Association: Annual Show at Woodville, 26th January.

Helensville A. and P. Association: Annual Show at Helensville, 29th January.

Feilding Industrial A. and P. Association: Annual Show at Feilding, 1st and 2nd February.

Golden Bay A. and P. Association: Annual Show at Takaka, 1st February.

Central A. and P. Association: Annual Show at Waipukurau, 2nd February.

Dannevirke District A. and P. Association: Show at Dannevirke, 9th and 10th February.

Franklin A. and P. Association: Annual Show at Pukekohe, 25th and 26th Feb.

Opotiki A. and P. Association: Show at Opotiki, 2nd March.

Ashburton A. and P. Association: Annual Show at Ashburton, 15th and 16th March.

Kaikoura A. and P. Association: Annual Show at Kaikoura, 17th March.

Temuka and Geraldine A. and P. Society: Show at Temuka, 30th March.